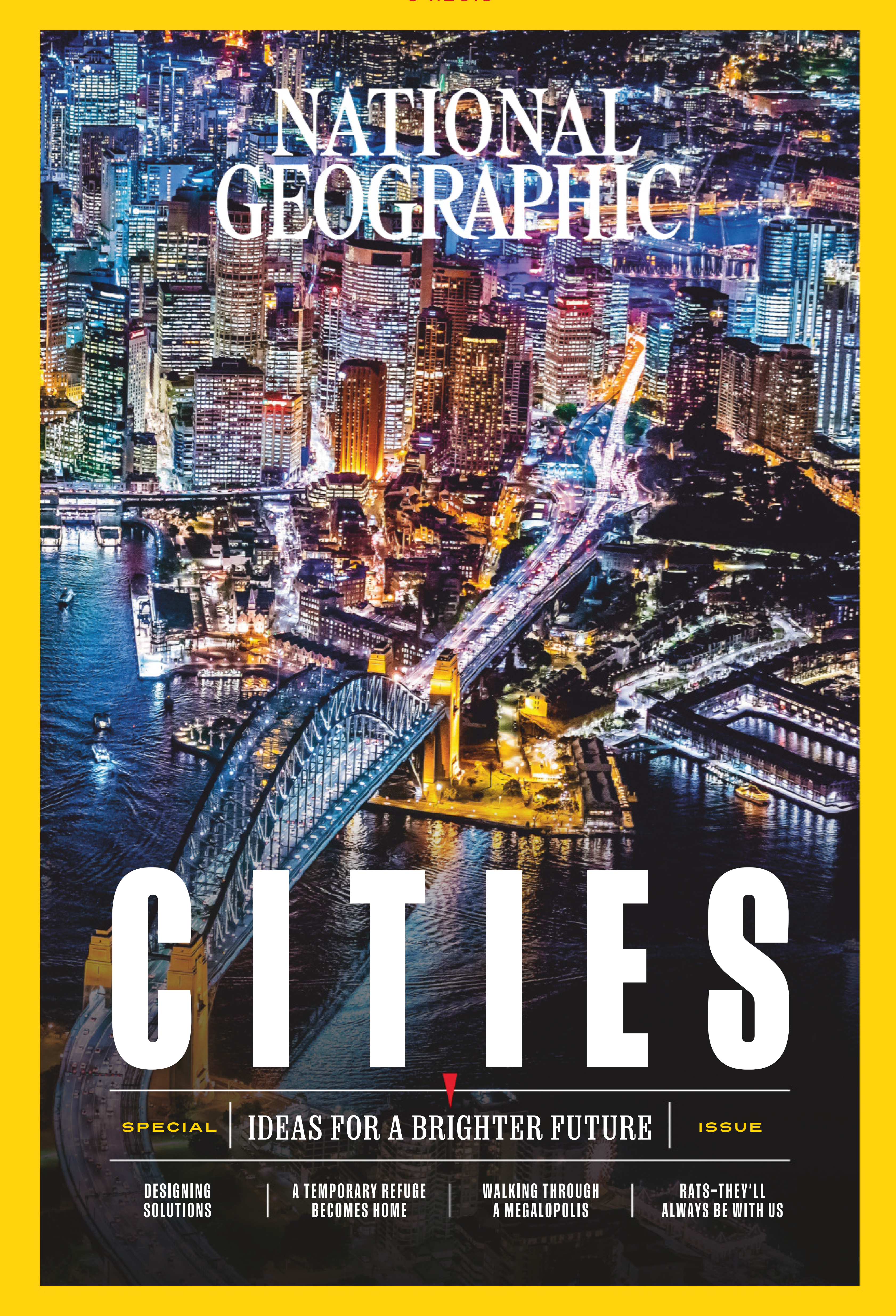
04.2019


NATIONAL GEOGRAPHIC
CITIES
SPECIAL
IDEAS FOR A BRIGHTER FUTURE
ISSUE
DESIGNING SOLUTIONS
A TEMPORARY REFUGE BECOMES HOME
WALKING THROUGH A MEGALOPOLIS
RATS–THEY'LL ALWAYS BE WITH US

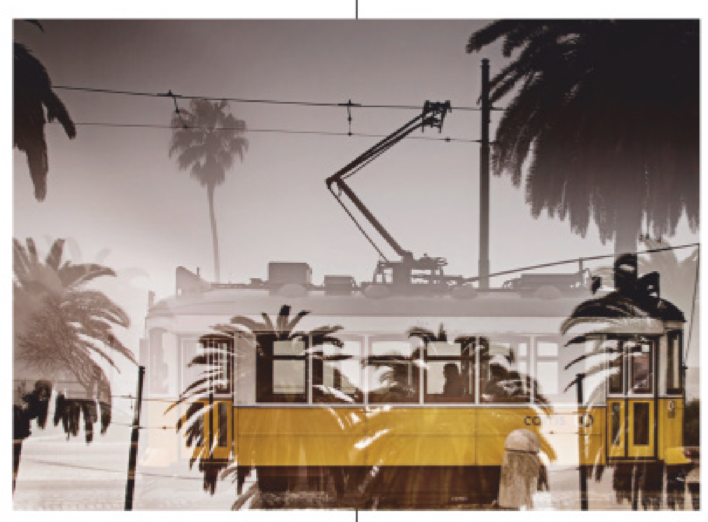
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Completed in 1932, Sydney Harbor Bridge leads the way into the glittering modern downtown of Australia's largest city.
VINCENT LAFORET

SPECIAL ISSUE: CITIES



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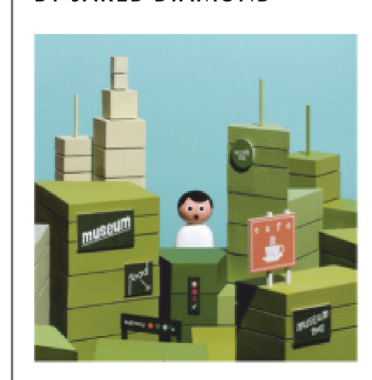
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BY JARED DIAMOND



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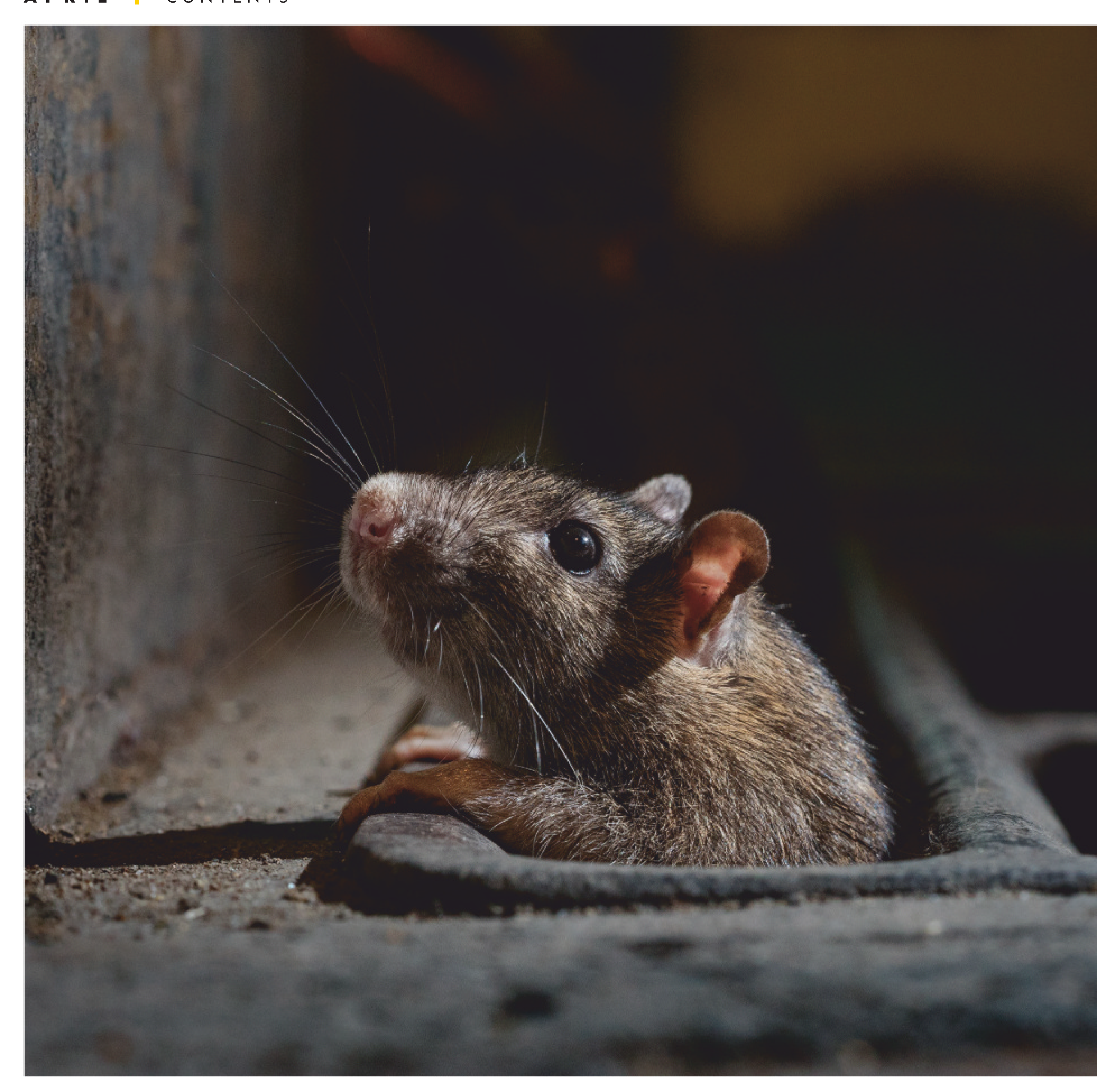
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Wherever there are people there are rats, thriving on our trash.
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NAT GEO TV

Listening to *The Story of God* as Told in Many Lands

In his series' third season, Morgan Freeman explores how different faiths regard their central figures, both deities and demons. His journey includes visits to Paris's Notre Dame Cathedral to see what's said to be the crown of thorns worn by Jesus and to Vietnam's Tay Ninh Province for a prayer service at a Cao Dai temple (above). Watch new episodes of *The Story of God* at 9/8c Tuesdays through April 9 and past episodes on the Nat Geo TV app and on demand.

TELEVISION

How Species Fare on Our *Hostile Planet*

As Earth's climate becomes more volatile, animals must adapt. See their struggles to survive in a six-part documentary hosted by adventurer Bear Grylls. *Hostile Planet* airs Mondays at 9/8c starting April 1 on National Geographic.

NAT GEO WILD

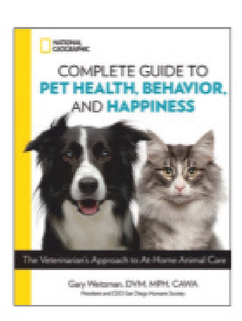
Go Inside *Animal Hospital LIVE*

Teams of specialized veterinarians at six animal hospitals across the country work tirelessly through the night handling emergencies in this live broadcast. *Animal Hospital LIVE* airs on Nat Geo WILD Saturdays and Sundays at 9/8c from March 30 through April 21.

BOOKS

Sit. Stay. Read (Our Pet Health Advice)

The *National Geographic Complete Guide to Pet Health, Behavior, and Happiness* brings the vet's office to you. This helpful tome is available at *shopng.com/books* and where books are sold.



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PHOTO: MARIA BOHE



REAL APPRECIATION

ISN'T SPOKEN, IT'S POURED.

– Raised Right –

JIM BEAM
BLACK

SPECIAL ISSUE

Cities and Solutions

BY **SUSAN GOLDBERG**



This engraving appears in *Civitates Orbis Terrarum (Cities of the World)*, an atlas of city maps that was published in six volumes between 1572 and 1617. It depicts the northeastern Italian city of Palmanova, founded in 1593 and built in a "star fort" configuration that studded thick walls with multiple bastions to improve the city's defenses.

IN 1925 LE CORBUSIER, the Swiss-French architect and pioneer of modernism, suggested razing the homes, statues, and streets of much of Paris's Right Bank. In their place, he proposed erecting 18 identical glass towers some 650 feet high, a quarter of a mile apart, divided by lawns for pedestrians and elevated highways for cars.

Le Corbusier contended that "lovers of antiques" and progressive thinkers were at war about how humans should live. A quote attributed to him leaves no doubt as to which side he was on: "Progress is achieved through experimentation; the decision will be awarded on the field of battle of the 'new.'"

This battle has long raged in and about cities, which are thought to have first formed some 6,000 years ago in what is now Iraq. We question how best to live en masse, how to coexist. The answers change with our need for security, with passing fad and fancy, and with advances in technology.

Should we live in dense urban areas with public transit and walkable amenities? In sprawling suburbs created by our infatuation with the car? In high-rises similar to those envisioned by Le Corbusier, now dotting urban districts across China? *National Geographic* has spent the past year exploring those questions for this month's special coverage of cities. We sent photographers and writers across the globe to document how cities work, and don't; from Tokyo—the planet's largest metropolis with more than 37 million inhabitants—to Bidibidi, Uganda, essentially an instant city of more than a quarter million people, formed by refugees who've arrived since August 2016.

We partnered with architectural firm SOM to create a detailed representation of the city of the future. And because we are *National Geographic*, we also covered an urban creature that follows us no matter what city we live in: rats.

What does the future hold for cities and for the two-thirds of us who'll live in them by 2050? While reporting our story "Rethinking Cities," writer Robert Kunzig spent time with Jan Gehl, a Copenhagen urban designer who, Kunzig says, is "revered for his simple insights." Let's end with one: Gehl's advice to be thoughtful about shaping cities, because we're building a legacy.

"Waking up every morning and knowing that the city is a little bit better than it was yesterday—that's very nice when you have children," Gehl says. "Think about that...your children have a better place to live, and your grandchildren have a better place to grow up than you could when you were young. I think that's what it should be like."

We hope you enjoy this special issue about cities and our extended coverage on *NationalGeographic.com*. □

ENGRAVING FROM *CIVITATES ORBIS TERRARUM*, BY GEORG BRAUN AND FRANZ HOGENBERG. PHOTO: DEA, A. DAGLI ORTI, DE AGOSTINI, GETTY IMAGES

WHAT WAS IT AGAIN THAT YOU WERE
THINKING ABOUT BEFORE YOU READ THIS
AD FOR OATMILK? WHATEVER IT WAS
I AM PRETTY SURE IT CAN WAIT A
SECOND SO THAT YOU CAN READ THE
END OF THIS SENTENCE WHICH REALLY
ONLY WANTS TO TELL YOU THAT OAT-
MILK IS WHAT YOU WERE THINKING
ABOUT, OATMILK IS WHAT YOU WILL
ALWAYS BE THINKING ABOUT
BECAUSE NOW THIS SEN-
TENCE SHIFTED TENSE
AND YOU ARE ALREADY
IN THE FUTURE THINK-
ING ABOUT OATMILK.

PROOF



PHOTOGRAPHS BY **NICOLAS RUEL**

NATIONAL GEOGRAPHIC

LOOKING AT THE EARTH FROM EVERY POSSIBLE ANGLE

Verdant Victoria Peak overlooks high-rise towers in densely populated Hong Kong. Photographer Nicolas Ruel connects both views in one image.

DOUBLE VISION

Eight seconds is all it takes to create astounding images of the world's busiest places.

VOL. 235 NO. 4




ANNO
SHOARMA
GUINNESS
CASINO CITY
BAR



By the canals of Amsterdam's famed red-light district, Ruel used a double exposure to capture the neighborhood's layers—a metaphor for what goes on behind closed doors.



Under the dome of Berlin's Reichstag, where one branch of the German parliament meets, visitors appear to explore the space in different dimensions.



THE BACKSTORY

CAN YOU SEE A PLACE FROM MULTIPLE ANGLES AT ONCE? YES, WITH SOME HELP.

PHOTOGRAPHER Nicolas Ruel usually takes eight seconds to make his long-exposure images. Why not less time—or more? “Eight is the number of infinity,” he says, referring to what he hopes is the endless wonder of looking and looking again at his double-take images of cityscapes around the world.

He starts with an urban place filled with people, energy, and motion. Train stations work well, as do churches, libraries, and stadiums—anywhere that people gather. He sets his tripod and takes a four-second exposure in one direction (most photo exposures are about 1/60 of a second or less). Then, with the shutter still open, he’ll swivel the camera to a different view for another four-second exposure—creating, ultimately, an eight-second one-frame documentary.

Long exposures typically show motion blur. Double exposures often mesh two images. But using both techniques from the same point offers a sense of depth, allowing the viewer to stand in a single spot and take a look around. Human places, rather than wild spaces, attract Ruel most. They’re dramatically different from one second to the next, constantly changing. As a result, New York’s Times Square or London’s Oxford Circus, two of the world’s most photographed locations, spring to life through Ruel’s camera with views not seen before.

Ruel searches for new places to photograph in urban spaces, the more vibrant the better. A series that started with eight cities now has 68, and Ruel’s goal is 100. But he leaves open the possibility that just like the images, the series may, in a way, be infinite. –DANIEL STONE



From every angle, London’s Oxford Circus is filled with movement, energy, and crowds.



FIRST & ONLY TREATMENT APPROVED for people with unresectable Stage 3 non-small cell lung cancer (NSCLC) whose disease has not progressed following concurrent chemoradiation therapy (CRT).

IMFINZI SIGNIFICANTLY REDUCED THE CHANCE OF LUNG CANCER SPREADING

IMFINZI may not work for everyone.

IMFINZI is an immunotherapy. People receiving IMFINZI had a 48% lower chance of lung cancer growing or spreading than those receiving placebo (no medicine). It was also proven to give people 3x more time without their cancer spreading compared with placebo.* Before IMFINZI, the last 10 years showed only limited advancements to the current standard of care for unresectable Stage 3 NSCLC.

*In a clinical trial, the median time tumors did not grow or spread was 16.8 months for the 476 patients receiving IMFINZI compared with 5.6 months for the 237 patients receiving placebo. Median is the middle number in a group of numbers arranged from lowest to highest. Individual results may vary.

ASK YOUR DOCTOR ABOUT IMFINZI. VISIT IMFINZI.COM

IMFINZI was studied in 713 patients with unresectable Stage 3 NSCLC who completed at least 2 cycles of chemotherapy that contained platinum given at the same time (concurrent) as radiation before starting the trial. Patients in the study had good performance status (WHO 0 or 1). IMFINZI was tested against placebo (no medication).

The main goal of the trial was to measure the length of time people remained progression free (without cancer growing or spreading) and overall survival. At the time of analysis, overall survival comparison was not yet available. This trial is still ongoing.

WHO IS IMFINZI FOR?

IMFINZI® (durvalumab) is a prescription medicine used to treat a type of lung cancer called non-small cell lung cancer (NSCLC). IMFINZI may be used when your NSCLC has not spread outside your chest, cannot be removed by surgery, **and** has responded or stabilized with initial treatment with chemotherapy that contains platinum, given at the same time as radiation therapy.

It is not known if IMFINZI is safe and effective in children.

IMPORTANT SAFETY INFORMATION

What is the most important information I should know about IMFINZI?

IMFINZI is a medicine that may treat a type of lung cancer by working with your immune system.

IMFINZI can cause your immune system to attack normal organs and tissues and can affect the way they work. These problems can sometimes become serious or life-threatening and can lead to death.

Call or see your healthcare provider right away if you develop any symptoms of the following problems or if these symptoms get worse:

Lung problems (pneumonitis). Signs and symptoms may include new or worsening cough, shortness of breath, and chest pain.

Liver problems (hepatitis). Signs and symptoms may include yellowing of your skin or the whites of your eyes, severe nausea or vomiting, pain on the right side of your stomach area (abdomen), drowsiness, dark urine (tea colored), bleeding or bruising more easily than normal, and feeling less hungry than usual.

Intestinal problems (colitis). Signs and symptoms may include diarrhea or more bowel movements than usual; stools that are black, tarry, sticky, or have blood or mucus; and severe stomach-area (abdomen) pain or tenderness.

Hormone gland problems (especially the thyroid, adrenals, pituitary, and pancreas). Signs and symptoms that your hormone glands are not working properly may include headaches that will not go away or unusual headaches; extreme tiredness; weight gain or weight loss; dizziness or fainting; feeling more hungry or thirsty than usual; hair loss; feeling cold; constipation; your voice gets deeper; urinating more often than usual; nausea or vomiting; stomach-area (abdomen) pain; and changes in mood or behavior, such as decreased sex drive, irritability, or forgetfulness.

Kidney problems, including nephritis and kidney failure. Signs of kidney problems may include decrease in the amount of urine, blood in your urine, swelling of your ankles, and loss of appetite.

Skin problems. Signs may include rash, itching, and skin blistering.

Problems in other organs. Signs and symptoms may include neck stiffness; headache; confusion; fever; chest pain, shortness of breath, or irregular heartbeat (myocarditis); changes in mood or behavior; low red blood cells (anemia); excessive bleeding or bruising; muscle weakness or muscle pain; blurry vision, double vision, or other vision problems; and eye pain or redness.

Severe infections. Signs and symptoms may include fever, cough, frequent urination, pain when urinating, and flu-like symptoms.

Severe infusion reactions. Signs and symptoms may include chills or shaking, itching or rash, flushing, shortness of breath or wheezing, dizziness, fever, feeling like passing out, back or neck pain, and facial swelling.

Getting medical treatment right away may help keep these problems from becoming more serious. Your healthcare provider will check you for these problems during your treatment with IMFINZI. Your healthcare provider may treat you with corticosteroid or hormone replacement medicines. Your healthcare provider may delay or completely stop treatment with IMFINZI if you have severe side effects.

Before you receive IMFINZI, tell your healthcare provider about all of your medical conditions, including if you have immune system problems such as Crohn's disease, ulcerative colitis, or lupus; have had an organ transplant; have lung or breathing problems; have liver problems; or are being treated for an infection.

If you are pregnant or plan to become pregnant, tell your healthcare provider. IMFINZI can harm your unborn baby. If you are able to become pregnant, you should use an effective method of birth control during your treatment and for at least 3 months after the last dose of IMFINZI. Talk to your healthcare provider about which birth control methods to use. Tell your healthcare provider right away if you become pregnant during treatment with IMFINZI.

If you are breastfeeding or plan to breastfeed, tell your healthcare provider. It is not known if IMFINZI passes into breast milk. Do not breastfeed during treatment with IMFINZI and for at least 3 months after the last dose of IMFINZI.

Tell your healthcare provider about all the medicines you take. This includes prescription and over-the-counter medicines, vitamins, and herbal supplements.

What are the possible side effects of IMFINZI?

IMFINZI can cause serious side effects (see earlier).

The most common side effects in people with non-small cell lung cancer (NSCLC) include cough, feeling tired, inflammation in the lungs (pneumonitis), upper respiratory tract infections, shortness of breath, and rash.

Tell your healthcare provider if you have any side effect that bothers you or that does not go away. These are not all the possible side effects of IMFINZI. Ask your healthcare provider or pharmacist for more information.

Call your healthcare provider for medical advice about side effects.

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.FDA.gov/medwatch or call 1-800-FDA-1088.

Please see Brief Summary of complete Prescribing Information on the following page.

If you cannot afford your medications, AstraZeneca may be able to help. Visit AstraZeneca-us.com to find out how.





IMPORTANT INFORMATION ABOUT IMFINZI® (im-FIN-zee) (durvalumab) INJECTION



WHAT IS THE MOST IMPORTANT INFORMATION I SHOULD KNOW ABOUT IMFINZI?

IMFINZI is a medicine that may treat a type of lung cancer by working with your immune system.

IMFINZI can cause your immune system to attack normal organs and tissues and can affect the way they work. These problems can sometimes become serious or life-threatening and can lead to death.

Call or see your healthcare provider right away if you develop any symptoms of the following problems or these symptoms get worse:

Lung problems (pneumonitis). Signs and symptoms of pneumonitis may include:

- new or worsening cough
- shortness of breath
- chest pain

Liver problems (hepatitis). Signs and symptoms of hepatitis may include:

- yellowing of your skin or the whites of your eyes
- severe nausea or vomiting
- pain on the right side of your stomach area (abdomen)
- drowsiness
- dark urine (tea colored)
- bleeding or bruising more easily than normal
- feeling less hungry than usual

Intestinal problems (colitis). Signs and symptoms of colitis may include:

- diarrhea or more bowel movements than usual
- stools that are black, tarry, sticky, or have blood or mucus
- severe stomach area (abdomen) pain or tenderness

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- headaches that will not go away or unusual headaches
- extreme tiredness
- weight gain or weight loss
- dizziness or fainting
- feeling more hungry or thirsty than usual
- hair loss
- changes in mood or behavior, such as decreased sex drive, irritability, or forgetfulness
- feeling cold
- constipation
- your voice gets deeper
- urinating more often than usual
- nausea or vomiting
- stomach area (abdomen) pain

Kidney problems, including nephritis and kidney failure. Signs of kidney problems may include:

- decrease in the amount of urine
- blood in your urine
- swelling of your ankles
- loss of appetite

Skin problems. Signs of these problems may include:

- rash
- itching
- skin blistering

(continued)

Problems in other organs. Signs and symptoms may include:

- neck stiffness
- headache
- confusion
- fever
- chest pain, shortness of breath, or irregular heartbeat (myocarditis)
- changes in mood or behavior
- low red blood cells (anemia)
- excessive bleeding or bruising
- muscle weakness or muscle pain
- blurry vision, double vision, or other vision problems
- eye pain or redness

Severe infections. Signs and symptoms may include:

- fever
- cough
- frequent urination
- pain when urinating
- flu-like symptoms

Severe infusion reactions. Signs and symptoms of severe infusion reactions may include:

- chills or shaking
- itching or rash
- flushing
- shortness of breath or wheezing
- dizziness
- fever
- feel like passing out
- back or neck pain
- facial swelling

Getting medical treatment right away may help keep these problems from becoming more serious.

Your healthcare provider will check you for these problems during your treatment with IMFINZI. Your healthcare provider may treat you with corticosteroid or hormone replacement medicines. Your healthcare provider may delay or completely stop treatment with IMFINZI, if you have severe side effects.

WHAT IS IMFINZI?

IMFINZI is a prescription medicine used to treat:

- a type of lung cancer called non-small cell lung cancer (NSCLC). IMFINZI may be used when your NSCLC:
  - has not spread outside your chest
  - cannot be removed by surgery, **and**
  - has responded or stabilized with initial treatment with chemotherapy that contains platinum, given at the same time as radiation therapy.

It is not known if IMFINZI is safe and effective in children.

Before you receive IMFINZI, tell your healthcare provider about all of your medical conditions, including if you:

- have immune system problems such as Crohn's disease, ulcerative colitis, or lupus
- have had an organ transplant
- have lung or breathing problems
- have liver problems
- are being treated for an infection
- are pregnant or plan to become pregnant. IMFINZI can harm your unborn baby. If you are able to become pregnant, you should use an effective method of birth control during your treatment and for at least 3 months after the last dose of IMFINZI. Talk to your healthcare provider about birth control methods that you can use during this time. Tell your healthcare provider right away if you become pregnant during treatment with IMFINZI.
- are breastfeeding or plan to breastfeed. It is not known if IMFINZI passes into your breast milk. Do not breastfeed during treatment and for at least 3 months after the last dose of IMFINZI.

(continued)

Tell your healthcare provider about all the medicines you take, including prescription and over-the-counter medicines, vitamins, and herbal supplements.

HOW WILL I RECEIVE IMFINZI?

- Your healthcare provider will give you IMFINZI into your vein through an intravenous (IV) line over 60 minutes.
- IMFINZI is usually given every 2 weeks.
- Your healthcare provider will decide how many treatments you need.
- Your healthcare provider will test your blood to check you for certain side effects.
- If you miss any appointments, call your healthcare provider as soon as possible to reschedule your appointment.

WHAT ARE THE POSSIBLE SIDE EFFECTS OF IMFINZI?

IMFINZI CAN CAUSE SERIOUS SIDE EFFECTS, INCLUDING:

SEE "WHAT IS THE MOST IMPORTANT INFORMATION I SHOULD KNOW ABOUT IMFINZI?"

The most common side effects of IMFINZI in people with NSCLC include:

- cough
- feeling tired
- inflammation in the lungs (pneumonitis)
- upper respiratory tract infections
- shortness of breath
- rash

Tell your healthcare provider if you have any side effect that bothers you or that does not go away.

These are not all the possible side effects of IMFINZI. Ask your healthcare provider or pharmacist for more information. Call your healthcare provider for medical advice about side effects. You may report side effects to FDA at 1-800-FDA-1088.

GENERAL INFORMATION ABOUT THE SAFE AND EFFECTIVE USE OF IMFINZI.

Medicines are sometimes prescribed for purposes other than those listed in a Medication Guide. If you would like more information about IMFINZI, talk with your healthcare provider. You can ask your healthcare provider for information about IMFINZI that is written for health professionals.



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IN THIS SECTION
Imagining Future Cities
Modernizing Kansas City
Skiing Copenhagen
Fixing Urban Water



THE DISCOVERIES OF TODAY THAT WILL DEFINE THE WORLD OF TOMORROW
NATIONAL GEOGRAPHIC | VOL. 235 NO. 4

What We Gain or Lose in Cities

INDIVIDUAL FREEDOM OR COMMUNITY INTERESTS? SOCIAL TIES OR ANONYMITY? URBAN LIFE ASKS US TO MAKE TRADE-OFFS.

BY **JARED DIAMOND**



FOR MOST OF THE SIX MILLION YEARS of human evolution, all humans and protohumans lived like somewhat glorified chimpanzees, at low population densities, scattered over the landscape as families or small bands. Only within the past 6,000 years, a small fraction of human history, did some of our ancestors come together in cities. But today more than half the world's people live in these new settings, some of which have tens of millions of inhabitants.

Urban life involves trade-offs. We may gain big benefits in return for suffering big disadvantages. Let's consider two of them: the trade-off between individual freedom and community interests, and the trade-off between social ties and anonymity.

To understand the issue of freedom, take first the city of Singapore, in effect one of the world's most densely populated micro-countries. Singapore's nearly six million people are packed into about 250 square miles—230 times the average U.S. population

> SINGAPORE CITIZENS' BARGAIN WITH THEIR GOVERNMENT: LESS INDIVIDUAL FREEDOM IN RETURN FOR FIRST WORLD LIVING STANDARDS.

density. It's an Asian financial center, a major port on one of the world's busiest shipping straits, and a tiny piece of prime real estate wedged between two giant, powerful neighbors, Indonesia and Malaysia. Singapore was part of Malaysia until 1965, when economic and racial tensions spurred its separation. But Singapore depends on Malaysia for most of its water and much of its food, and can't afford to make mistakes or provoke its neighbors.

So Singapore's government monitors its citizens closely, to make sure that individuals don't harm the community. Inspectors check for water standing in each household's pots, lest they furnish breeding sites for disease-transmitting mosquitoes. Smart-technology sensors measure (or will measure) the traffic on every street, the movements of every car, and the temperatures of and shadows cast by buildings. They also will track the water and electricity consumption of every household and will note the time whenever a household toilet is flushed. Americans may view such measures with horror, as George Orwell's novel *1984* come true. But for Singapore's citizens, it's the bargain that they have made with their government: less individual freedom in return for First World living standards, health, and security.

Next consider Germany's cities, also densely populated. Local governments have rules about the shapes and colors of tiles that Germans may use on their houses' roofs, and about the sizes and ages of trees that they can or can't cut down on their property. To obtain a fishing license, Germans must attend many hours of fishing classes, then pass a 60-question exam. Most Americans would bristle at such restrictions. But benefits to German communities include beautiful regional architecture, green cities, government support for the arts, and healthy fish populations.

At the opposite extreme comes my own city of Los Angeles, where rights of the individual property owner are prized as sacred. The result is a free-for-all, in which many individuals and communities suffer disadvantages. Almost any style of house is permissible; local architectural character is nonexistent. Tree cover is vanishing, temperatures are rising, and landowners' excavated dirt and sprayed pesticides end up on neighbors' property. To fish in the local bay waters, anyone can buy a fishing license—no questions asked—so of course fish populations decline.

The outcomes of trade-offs differ for Singapore, Germany, and L.A. because different geographies and histories have led to different customs. Population density is highest in Singapore, intermediate in Germany, lowest in the United States (including California). China—whence the ancestors of most of Singapore's population arrived—has had cities for five millennia, Germany for two millennia, the United States for just a few centuries. Chinese traditional farming is communal; Germans have close-packed individual farms; and U.S. frontier settlements had self-sufficient, widely scattered families. The cultural legacies of those differences live on today.

ANOTHER ISSUE OF URBAN LIFE is the trade-off between social ties and anonymity. Traditional living arrangements still practiced today in rural areas of New Guinea, where I've been working since the 1960s, resemble those formerly practiced in pre-urban Western societies. New Guinea villagers live out their lives where they were born, constantly surrounded by lifelong friends and social support.

A first reaction of many lonely, urban Americans is: How heartwarmingly wonderful! When New Guinea villagers move to cities, they find themselves surrounded by strangers, their friends few or recent or scattered across the city. The frequent results are unhappy isolation, decline of social support, and proliferation of urban crime.

Still, we American city dwellers shouldn't romanticize traditional village living arrangements. My New Guinea friends tell me that those arrangements are also socially suffocating, and limit individuals' abilities to realize their potential. In New Guinea villages, everybody knows, constantly watches, and incessantly discusses what everybody else is doing.

As a result, a New Guinea friend who spent years living in a U.S. city loved it—because (as she told me) she could sit alone and read a newspaper in peaceful anonymity in a sidewalk café, without being importuned by fellow clan members asking her for money and bewailing their troubles. New Guineans have learned to appreciate the modern urban inventions of opaque bags and trouser pockets—because those inventions permit them to conceal things from neighbors and thereby to acquire small luxuries without becoming targets of village comment. Thus, New Guineans recognize drawbacks as well as heartwarming benefits of village life. They also understand the benefits, not just the pains, of urban anonymity.

IT ALL COMES DOWN to compromises. As the world becomes increasingly urban, will all of us be forced to adopt more of Singapore's solutions? If a government meter that records every flushing of your toilet is part of the price you'd have to pay for living in safety, health, affluence, and beautiful surroundings, what would you choose? ☐

Jared Diamond is a professor of geography at the University of California, Los Angeles, and the Pulitzer Prize–winning author of the book *Guns, Germs, and Steel.* This essay is drawn from his latest book—*Upheaval: Turning Points for Nations in Crisis*—which comes out in May.



ILLUSTRATION: HUDSON CHRISTIE

HOW COULD HEALTHCARE GET BETTER?

During your morning jog, sensors in your wearable detect a medical anomaly. The data is sent to your electronic health records where algorithms flag it up as a potential problem, alerting your doctor. Equipped with up-to-date details of your lifestyle, medical history, and your fully mapped genome, AI analysis offers a diagnosis. Your doctor videocalls you and suggests precautionary tests. In our high-tech healthcare future, computers could know what's wrong with us before we even know we're sick.



At the start of the 20th century many illnesses went unidentified, the human body was largely unmapped, nutrition was widely misunderstood, and medical treatments remained limited. Progress has been rapid. The mapping of our genomes and the development of CT and MRI scans have given us unparalleled medical insight. Antibiotics have revolutionized the battle against bacteria, antiviral drugs control deadly viruses, and widespread inoculations have all but eliminated smallpox, diphtheria, and polio. Organ transplants, immunotherapy, chemotherapy, pacemakers, stem-cells, and advanced prosthetics are among the innovative treatments beating some devastating conditions. As a result, life expectancy has risen from under 50 to over 80 in some countries.

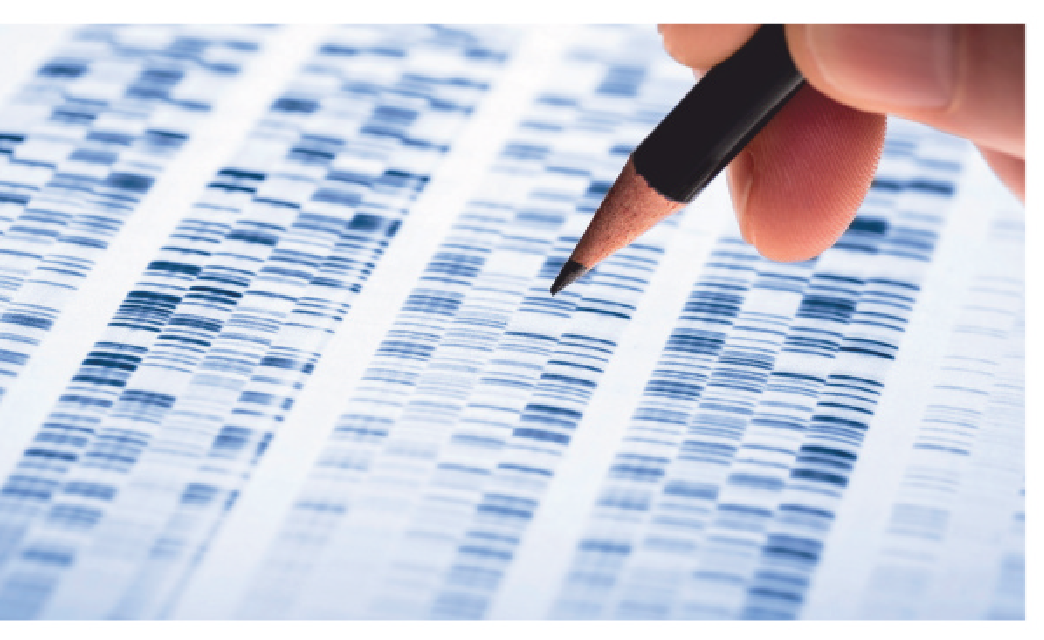
But people still get sick. Cancer and heart disease continue to be among the world's biggest killers, while arthritis, diabetes, dementia, and countless other chronic conditions mean a poor quality of life for millions—around 60% of American adults have a chronic condition, and, of those, 40% have two or more.

FORMIDABLE NEW DISEASES ARE EMERGING, SUCH AS EBOLA AND THE ZIKA VIRUS, WHILE THE LIFE-SAVING EFFECTS OF ANTIBIOTICS ARE WEARING OFF THROUGH DECADES OF OVERUSE AND HALF THE WORLD STILL LACKS ACCESS TO ESSENTIAL HEALTH SERVICES.

As efforts continue to improve global healthcare, from building clinics to delivering immunization programs, technology is driving some exciting medical advances that could help make healthcare better.

Prevention is better than cure, and improved knowledge of our bodies is helping people to stay healthier for longer. While some diseases are literally written in our genes, we increasingly respect the benefits of a healthy diet, plenty of

exercise, and avoiding bad lifestyle choices. Encouraged to take responsibility for our own health, we know our numbers, look closely at food labels, and use wearables to motivate a healthier lifestyle that could pay dividends in an old age that could last a long time. The fundamental goal of healthcare continues to shift from reacting when someone is ill, to keeping people well.





Early diagnosis is crucial for treatment, and technology is really speeding things up. Smart tech, whether wearables, specialized sensors, or the ubiquitous smartphone, could soon monitor heart, weight, blood pressure, and physical activity, delivering a constant stream of data. Algorithms could analyze this and suggest interventions ranging from tests for specific diseases to alerting emergency services of a fall or stroke. Such real-time, round-the-clock monitoring would add extraordinary detail to a patient's electronic health record (EHR) that digitally stores their complete medical history. They're already used by 94% of US hospitals, so Big Data could analyze EHRs for everything from the effectiveness of specific cancer treatments to the spread of infectious diseases.

As genome mapping becomes increasingly available, it now costs under $2,000, clinicians have a unique insight into a patient's medical destiny, and perhaps the opportunity to outmaneuver mutated genes. A growing library of biomarkers could form the basis of quick and simple diagnostic tests, while nanotechnology could search for specific viruses and bacteria—changing color if they are detected. Of the billions of medical images created each year, AI could interpret them so effectively that most may never be seen by humans. Increasingly diagnosis could be done remotely, with EHRs shared between specialists in different locations, and doctors using internet-based tools for consultations and tests. Interactive Chatbots are already employing sophisticated AI to provide accurate diagnosis based on a vast medical database and an understanding of the idiosyncrasies people use to describe symptoms. Such advances save more than time and money, they make healthcare more accessible.

Medicines are the most common medical intervention but making them is expensive and reassuringly difficult—in 2016 just 22 new drugs were approved in America. The computing power of AI could transform this, drastically cutting the time taken to find leads and analyze data from testing and trials.

> **AI COULD CALCULATE HOW MOLECULAR COMBINATIONS MIGHT BEHAVE AND BETTER PREDICT THE RELATIONSHIPS BETWEEN DRUGS, DISEASES, AND PATIENTS.**

AI can even repurpose existing drugs: analysis of medical data discovered that the anti-depressant desipramine could help combat lung cancer.

AS WE INCREASINGLY UNDERSTAND THE MECHANICS OF INDIVIDUAL PATIENTS AND SPECIFIC DISEASES, HEALTHCARE COULD SHIFT TOWARDS PERSONALIZED MEDICINE PRECISELY TAILORED TO AN INDIVIDUAL'S UNIQUE NEEDS AND GENETICS.

Genome editing, could permanently and precisely cut, repair, or replace the mutated genes that cause conditions like cystic fibrosis, while similar techniques could boost particular protein-producing genes to cure incurable diseases like muscular dystrophy. Advances in immunotherapy, drugs that alert the immune system to hidden tumors, could help to control



previously untreatable diseases such as mesothelioma. Research into regenerative medicine is progressing, with stem cells being used to generate healthy cells that could replace diseased or damaged cells—such as the beta cells attacked by the immune system in diabetes.

Companion robots, capable of simple tasks like carrying drinks and fetching medication, could keep people living independently for longer. In Japan, assistive robots already lift and carry patients, and highly dexterous robots could be developed to perform more complex procedures including surgery. The extraordinary properties of nanotechnology could speed up treatments and healing time, while nanobots could deliver drugs to precisely targeted cancer cells and might be programmed to destroy bacteria—superseding our over-reliance on antibiotics. Ever more sophisticated replacement body parts could soon outperform nature with bionic limbs, voice-recognition hearing aids, and even an artificial pancreas for diabetics. 3D printing can already create teeth implants in just a few hours and could soon print pills or medical instruments in the field, while augmented reality glasses can provide extremely accurate overlays to assist with surgery or even label people and objects to help dementia sufferers.

MOST OF THESE ADVANCES ARE IN DEVELOPMENT, SOME ARE ALREADY IN USE, AND ALL COULD BE FEASIBLE IN THE NEAR FUTURE.

If employed, they could contribute to a growing population and an ageing population, but crucially to a healthier population in which old age won't necessarily mean poor health. As we look to a world where people might routinely live to 100, we're winning the race to longevity: now healthcare must drive development of treatments, cures, and procedures that could ensure a healthier life—for longer.

FROM
MEGA-REGIONS

CITIES OF THE FUTURE

TO
MICRO-SIZE HOMES

PEOPLE AND NATURE COME FIRST IN THIS BOLD VISION OF A NEXT-GENERATION CITY.



By 2050 the world's population is expected to reach 9.8 billion. Nearly 70 percent—6.7 billion people—are projected to live in urban areas. We asked the architectural and urban planning firm Skidmore, Owings & Merrill (SOM) a question: How would it design a city of the future? The plan allows **ECOLOGY** to guide development. **WATER** sources are protected and systems are designed to capture, treat, and reuse it. **ENERGY** is renewable, and the city becomes more **LIVABLE** even as it becomes more densely populated. All **WASTE** becomes a resource. **FOOD** is grown locally and sustainably. High-speed rail improves **MOBILITY**. The **CULTURE AND HERITAGE** of the increasingly diverse population are publicly supported. The **INFRASTRUCTURE** is carbon-neutral, and the **ECONOMY** is largely automated and online.



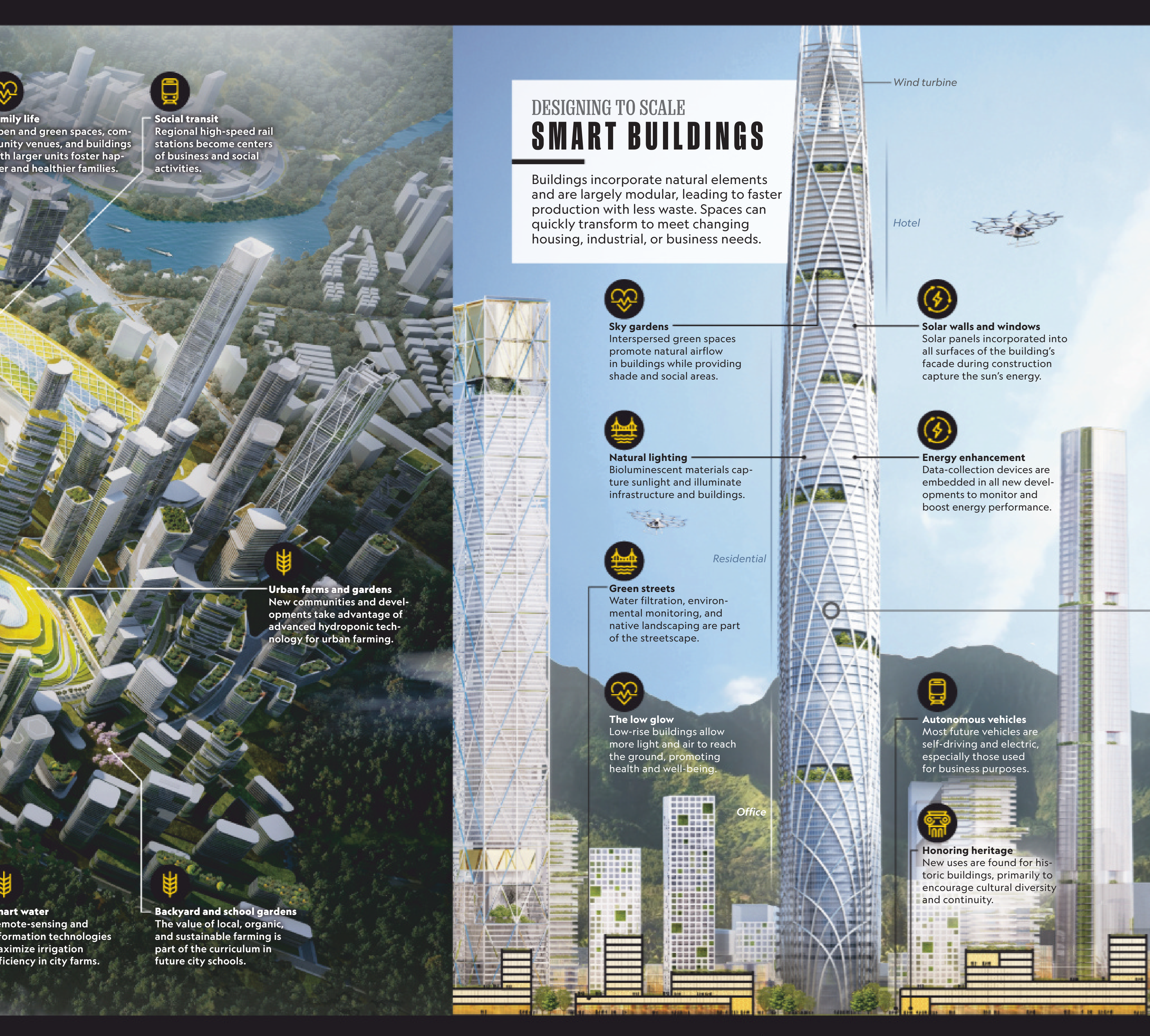
PRINCIPLES OF CITY DESIGN

ECOLOGY

The future city is designed around natural features and forces, protecting wildlife habitat and natural resources. Based on a unified vision for the region, the city is compact and dense to limit impacts on the ecosystem.

WATER

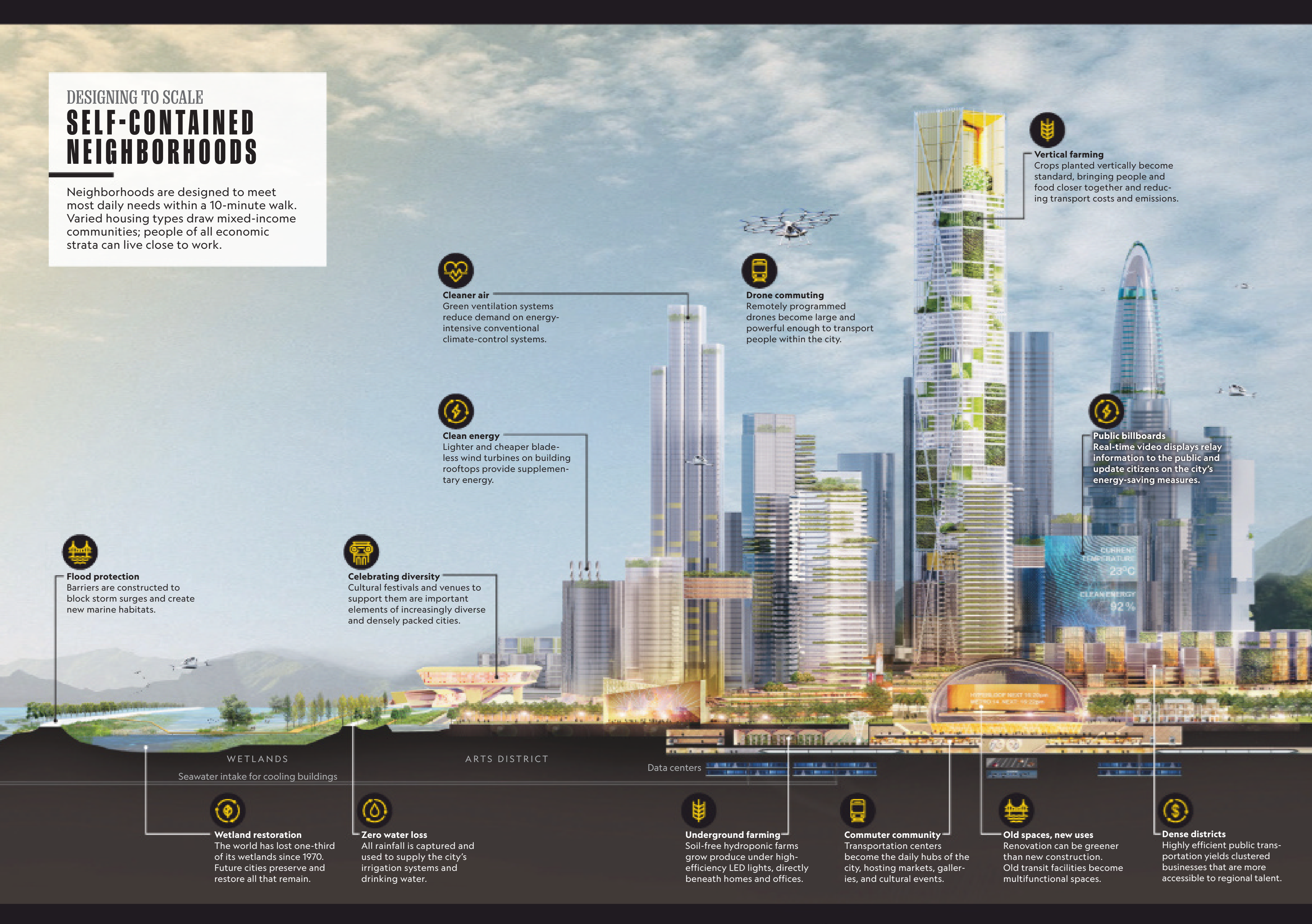
Protecting upland water systems and rigorous collec-tion and cleansing of



ormwater improve ater quality. Wetnd restoration and ponge-city measures evive habitats and rotect against flooding and sea-level rise.

ENERGY

In the city of the future, energy is 100 percent renewable. Enough power is produced within or close to the city for it to be self-sufficient. Area buildings share energy resources, generating as much energy as they consume.

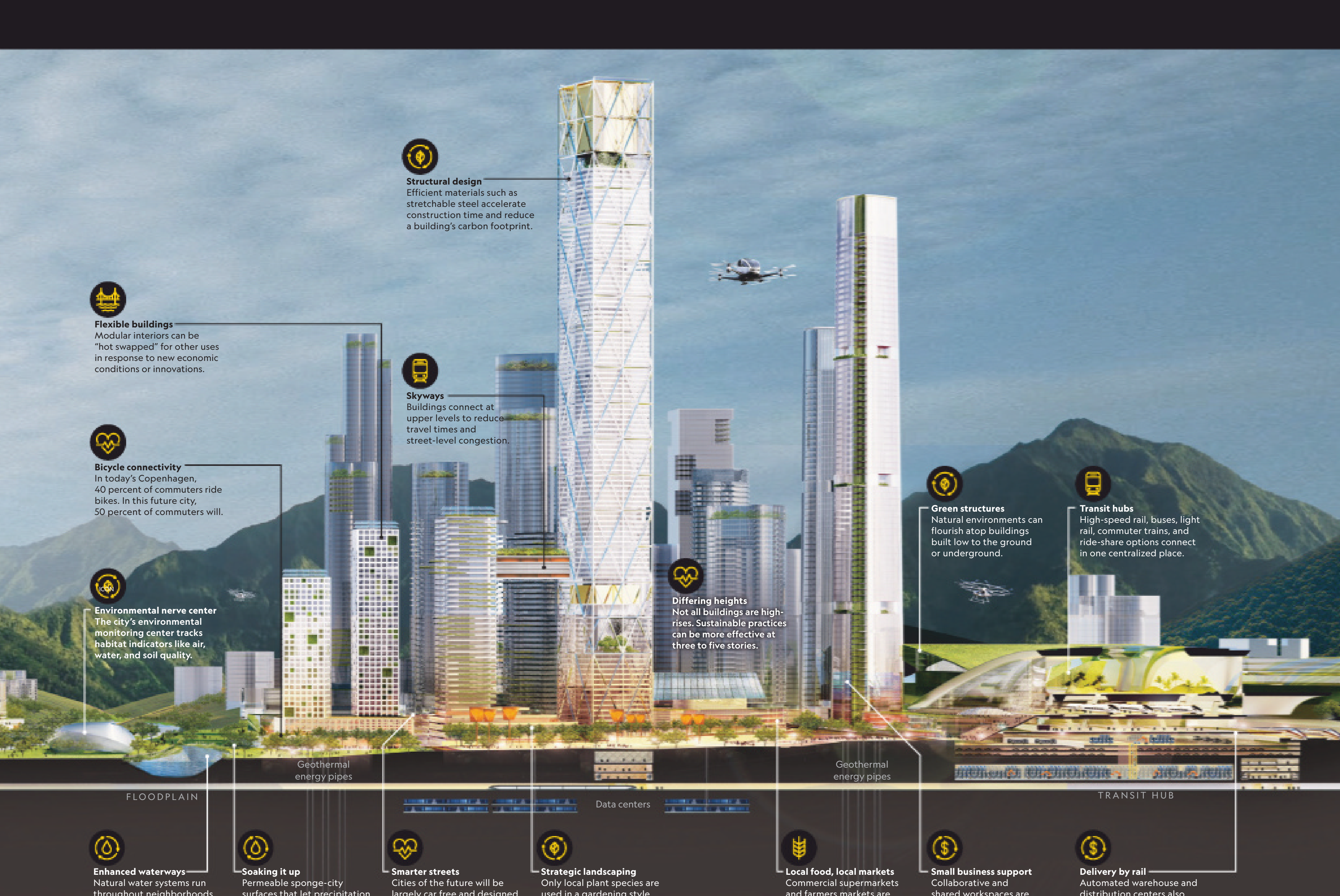


WASTE

Waste becomes a resource to produce energy or alternative material. Landfills and abandoned industrial areas are gradually converted to other purposes after soil remediation. Wastewater is treated for irrigation or human consumption.

FOOD

Sustainability practices are mandated across the life cycle of a product, from food production to delivery and disposal. Global standards are established for organic farming and animal treatment; most produce is locally sourced.



MOBILITY

Traveling in the city of the future is more affordable, safe, and convenient because of automated technology and high-speed rail. Fewer personal automobiles are on the road and more pedestrian space is available.

CULTURE

In the densely populated and diverse city of the future, historical heritage is preserved and celebrated. Recreation, arts, and entertainment can be shared globally through virtual and augmented reality.

DESIGNING TO SCALE

SOCIAL INTERIORS

Shared spaces and amenities increase human interaction and allow for smaller and micro-size homes. Community-wide activities aim to foster a sense of belonging and social equality.

Room to breathe
With fewer cars outside and more plants inside, air quality is improved and airborne particulates are reduced.

Intergenerational housing
Small and family-size units, as well as easy access to services and transit, welcome a range of ages in one building.

On-demand delivery
Smart refrigerators and pantries are automated to order food and other supplies for the home.

Recycling and reuse
Used items—those that aren't already biodegradable—are more easily reused or recycled in dense communities.

A future city for all
Future cities are fully accessible to the disabled, giving all residents unfettered access to goods and services.

DESIGNING TO SCALE

RESILIENT REGIONS

Future cities are composed of a series of urban hubs: dense developments connected by high-speed rail. The regional ecology dictates where and how hubs grow; city centers move inland, away from rising seas.



LIVABILITY

The city of the future is designed for accessibility and safety as more people populate urban areas. Residents have healthier lives with more streamlined access to nature, services, and automated technology.

INFRASTRUCTURE

Buildings are constructed more efficiently and include technology that can improve the quality of natural resources such as water, soil, and air. Infrastructure is designed for pedestrian access with limited roads for cars.



ECONOMY

The economy of the future city must work in tandem with policies that safeguard ecological sustainability. People adapt to more flexible working hours as artificial intelligence and automation become more widespread.

To merchants who have accepted Visa and Mastercard at any time from January 1, 2004 to January 25, 2019: Notice of a class action settlement of approximately $5.54-6.24 Billion.

Si desea leer este aviso en español, llámenos o visite nuestro sitio web, www.PaymentCardSettlement.com.

Notice of a class action settlement authorized by the U.S. District Court, Eastern District of New York.

This notice is authorized by the Court to inform you about an agreement to settle a class action lawsuit that may affect you. The lawsuit claims that Visa and Mastercard, separately, and together with certain banks, violated antitrust laws and caused merchants to pay excessive fees for accepting Visa and Mastercard credit and debit cards, including by:

- Agreeing to set, apply, and enforce rules about merchant fees (called *default interchange fees*);
- Limiting what merchants could do to encourage their customers to use other forms of payment; and
- Continuing that conduct after Visa and Mastercard changed their corporate structures.

The defendants say they have done nothing wrong. They say that their business practices are legal and the result of competition, and have benefitted merchants and consumers. The Court has not decided who is right because the parties agreed to a settlement. The Court has given preliminary approval to this settlement.

The Settlement

Under the settlement, Visa, Mastercard, and the bank defendants have agreed to provide approximately $6.24 billion in class settlement funds. Those funds are subject to a deduction to account for certain merchants that exclude themselves from the Rule 23(b)(3) Settlement Class, but in no event will the deduction be greater than $700 million. The net class settlement fund will be used to pay valid claims of merchants that accepted Visa or Mastercard credit or debit cards at any time between January 1, 2004 and January 25, 2019.

This settlement creates the following Rule 23(b)(3) Settlement Class: All persons, businesses, and other entities that have accepted any Visa-Branded Cards and/or Mastercard-Branded Cards in the United States at any time from January 1, 2004 to January 25, 2019, except that the Rule 23(b)(3) Settlement Class shall not include (a) the Dismissed Plaintiffs, (b) the United States government, (c) the named Defendants in this Action or their directors, officers, or members of their families, or (d) financial institutions that have issued Visa-Branded Cards or Mastercard-Branded Cards or acquired Visa-Branded Card transactions or Mastercard-Branded Card transactions at any time from January 1, 2004 to January 25, 2019. The Dismissed Plaintiffs are plaintiffs that previously settled and dismissed their own lawsuit against a Defendant, and entities related to those plaintiffs. If you are uncertain about whether you may be a Dismissed Plaintiff, you should call 1-800-625-6440 or visit www.PaymentCardSettlement.com for more information.

What Merchants will get from the Settlement

Every merchant in the Rule 23(b)(3) Settlement Class that does not exclude itself from the class by the deadline described below and files a valid claim will get money from the class settlement fund. The value of each claim will be based on the actual or estimated interchange fees attributable to the merchant's Mastercard and Visa payment card transactions from January 1, 2004 to January 25, 2019. *Pro rata* payments to merchants who file valid claims for a portion of the class settlement fund will be based on:

- The amount in the class settlement fund after the deductions described below,
- The deduction to account for certain merchants who exclude themselves from the class,
- Deductions for the cost of settlement administration and notice, applicable taxes on the settlement fund and any other related tax expenses, money awarded to the Rule 23(b)(3) Class Plaintiffs for their service on behalf of the Class, and attorneys' fees and expenses, all as approved by the Court, and
- The total dollar value of all valid claims filed.

Attorneys' fees and expenses and service awards for the Rule 23(b)(3) Class Plaintiffs: For work done through final approval of the settlement by the district court, Rule 23(b)(3) Class Counsel will ask the Court for attorneys' fees in an amount that is a reasonable proportion of the class settlement fund, not to exceed 10% of the class settlement fund, to compensate all of the lawyers and their law firms that have worked on the class case. For additional work to administer the settlement, distribute the funds, and litigate any appeals, Rule 23(b)(3) Class Counsel may seek reimbursement at their normal hourly rates. Rule 23(b)(3) Class Counsel will also request (i) an award of their litigation expenses (not including the administrative costs of settlement or notice), not to exceed $40 million and (ii) up to $250,000 per each of the eight Rule 23(b)(3) Class Plaintiffs in service awards for their efforts on behalf of the Rule 23(b)(3) Settlement Class.

How to Ask for Payment

To receive payment, merchants must fill out a claim form. If the Court finally approves the settlement, and you do not exclude yourself from the Rule 23(b)(3) Settlement Class, you will receive a claim form in the mail or by email. Or you may ask for one at: www.PaymentCardSettlement.com, or call: 1-800-625-6440.

Legal Rights and Options

Merchants who are included in this lawsuit have the legal rights and options explained below. You may:

- **File a claim to ask for payment.** Once you receive a claim form, you can submit it via mail or email, or may file it online at www.PaymentCardSettlement.com.
- **Exclude yourself** from the Rule 23(b)(3) Settlement Class. If you exclude yourself, you can individually sue the Defendants on your own at your own expense, if you want to. If you exclude yourself, you will not get any money from this settlement. If you are a merchant and wish to exclude yourself, you must make a written request, place it in an envelope, and mail it with postage prepaid and postmarked no later than **July 23, 2019**, or send it by overnight delivery shown as sent by **July 23, 2019**, to Class Administrator, Payment Card Interchange Fee Settlement, P.O. Box 2530, Portland, OR 97208-2530. Your written request must be signed by a person authorized to do so and provide all of the following information: (1) the words "In re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation," (2) your full name, address, telephone number, and taxpayer identification number, (3) the merchant that wishes to be excluded from the Rule 23(b)(3) Settlement

Class, and what position or authority you have to exclude the merchant, and (4) the business names, brand names, "doing business as" names, taxpayer identification number(s), and addresses of any stores or sales locations whose sales the merchant desires to be excluded. You also are requested to provide for each such business or brand name, if reasonably available: the legal name of any parent (if applicable), dates Visa or Mastercard card acceptance began (if after January 1, 2004) and ended (if prior to January 25, 2019), names of all banks that acquired the Visa or Mastercard card transactions, and acquiring merchant ID(s).

- **Object to the settlement.** The deadline to object is **July 23, 2019**. To learn how to object, visit www.PaymentCardSettlement.com or call 1-800-625-6440. Note: If you exclude yourself from the Rule 23(b)(3) Settlement Class you cannot object to the settlement.

For more information about these rights and options, visit: www.PaymentCardSettlement.com.

If the Court Approves the Final Settlement

Members of the Rule 23(b)(3) Settlement Class who do not exclude themselves by the deadline will be bound by the terms of this settlement, including the release of claims against the released parties provided in the settlement agreement, whether or not the members file a claim for payment.

The settlement will resolve and release claims by class members for monetary compensation or injunctive relief against Visa, Mastercard, or other defendants. The release bars the following claims:

- Claims based on conduct and rules that were alleged or raised in the litigation, or that could have been alleged or raised in the litigation relating to its subject matter. This includes any claims based on interchange fees, network fees, merchant discount fees, no-surcharge rules, no-discounting rules, honor-all-cards rules, and certain other conduct and rules. These claims are released if they already have accrued or accrue in the future up to five years following the court's approval of the settlement and the resolution of all appeals.
- Claims based on rules in the future that are substantially similar to – i.e., do not change substantively the nature of – the above-mentioned rules as they existed as of preliminary approval of the settlement. These claims based on future substantially similar rules are released if they accrue up to five years following the court's approval of the settlement and the resolution of all appeals.

The settlement's resolution and release of these claims is intended to be consistent with and no broader than federal law on the identical factual predicate doctrine.

The release does *not* extinguish the following claims:

- Claims based on conduct or rules that could not have been alleged or raised in the litigation.
- Claims based on future rules that are not substantially similar to rules that were or could have been alleged or raised in the litigation.
- Any claims that accrue more than five years after the court's approval of the settlement and the resolution of any appeals.

The release also will have the effect of extinguishing all similar or overlapping claims in any other actions, including but not limited to the claims asserted in a California state court class action brought on behalf of California citizen merchants and captioned *Nuts for Candy v. Visa, Inc., et al.*, No. 17-01482 (San Mateo County Superior Court). Pursuant to an agreement between the parties in *Nuts for Candy*, subject to and upon final approval of the settlement of the Rule 23(b)(3) Settlement Class, the plaintiff in *Nuts for Candy* will request that the California state court dismiss the *Nuts for Candy* action. Plaintiff's counsel in *Nuts for Candy* may seek an award in *Nuts for Candy* of attorneys' fees not to exceed $6,226,640.00 and expenses not to exceed $493,697.56. Any fees or expenses awarded in *Nuts for Candy* will be separately funded and will not reduce the settlement funds available to members of the Rule 23(b)(3) Settlement Class.

The release **does not** bar the injunctive relief claims or the declaratory relief claims that are a predicate for the injunctive relief claims asserted in the pending proposed Rule 23(b)(2) class action captioned *Barry's Cut Rate Stores, Inc., et. al. v. Visa, Inc., et al.*, MDL No. 1720, Docket No. 05-md-01720-MKB-JO ("*Barry's*"). Injunctive relief claims are claims to prohibit or require certain conduct. They do not include claims for payment of money, such as damages, restitution, or disgorgement. As to all such claims for declaratory or injunctive relief in *Barry's*, merchants will retain all rights pursuant to Rule 23 of the Federal Rules of Civil Procedure which they have as a named representative plaintiff or absent class member in *Barry's*, except that merchants remaining in the Rule 23(b)(3) Settlement Class **will release** their right to initiate a new and separate action for the period up to five (5) years following the court's approval of the settlement and the exhaustion of appeals.

The release also does not bar certain claims asserted in the class action captioned *B&R Supermarket, Inc., et al. v. Visa, Inc., et al.*, No. 17-CV-02738 (E.D.N.Y.), or claims based on certain standard commercial disputes arising in the ordinary course of business.

For more information on the release, see the full mailed Notice to Rule 23(b)(3) Settlement Class Members and the settlement agreement at: www.PaymentCardSettlement.com.

The Court Hearing about this Settlement

On **November 7, 2019**, there will be a Court hearing to decide whether to approve the proposed settlement. The hearing also will address the Rule 23(b)(3) Class Counsel's requests for attorneys' fees and expenses, and awards for the Rule 23(b)(3) Class Plaintiffs for their representation of merchants in MDL 1720, which culminated in the settlement agreement. The hearing will take place at:

United States District Court for the
Eastern District of New York
225 Cadman Plaza
Brooklyn, NY 11201

You do not have to go to the Court hearing or hire an attorney. But you can if you want to, at your own cost. The Court has appointed the law firms of Robins Kaplan LLP, Berger Montague PC, and Robbins Geller Rudman & Dowd LLP as Rule 23(b)(3) Class Counsel to represent the Rule 23(b)(3) Settlement Class.

Questions?

For more information about this case (*In re Payment Card Interchange Fee and Merchant Discount Antitrust Litigation*, MDL 1720), you may:

Call toll-free: 1-800-625-6440
Visit: www.PaymentCardSettlement.com
Write to the Class Administrator:
Payment Card Interchange Fee Settlement
P.O. Box 2530
Portland, OR 97208-2530
Email: info@PaymentCardSettlement.com

Please check www.PaymentCardSettlement.com for any updates relating to the settlement or the settlement approval process.



This seven- to 10-day-old baby pigeon was orphaned two days after hatching. A few weeks of nurturing left it healthy enough to be released, says Andrew Garn, author of *The New York Pigeon*.

HOW CITIES GOT PIGEONS

PHOTOGRAPH BY **ANDREW GARN**

THIS TINY PIGEON is a New York City native—but his ancestors were not. According to the New York Public Library, Europeans brought pigeons to U.S. shores, probably in the 1600s, to raise as food or as a hobby. Some pigeons escaped and made their way to cities, where the ledges of tall buildings were as hospitable for nesting as the cliffs of their wild homes. Unlike bird species with specialized diets, pigeons can thrive on almost anything, including humans' litter and leftovers. Small wonder that the world pigeon population is estimated at 400 million, with more than a million—and perhaps as many as seven million—of those in New York City.
—PATRICIA EDMONDS

DISPATCHES FROM THE FRONT LINES OF SCIENCE AND INNOVATION

Drones for Urban Tasks

Commercial drones may quadruple in U.S. skies by 2022. In cities, the uncrewed aircraft may be used to manage urban habitat, lug freight, and inspect buildings—but data they collect could be vulnerable to hacking.
—RACHEL BROWN



WATER

Inspector Robot

Twenty to 30 percent of the world's urban water supply is lost to leaks each year. "In many cities, we don't even know where the pipes are," says You Wu of WatchTower Robotics. As an MIT student, Wu developed a squishy, shuttlecock-shaped robot that, when dropped into a water system, records the location of fractures. The next step? "A robot that can not only detect leaks but also repair them," says Wu.
—KRISTIN ROMEY





TRANSPORTATION

EVERYTHING'S UP-TO-DATE IN KANSAS CITY

SMART TECHNOLOGY IS REVIVING STREETCARS.

The streetcar system in Kansas City, Missouri, was once one of the most robust in the country. In 2016, 59 years after it ceased service, a new incarnation got on track, with smart technology playing a key role. The sleek new streetcars have notched more than five million free rides in their first two and a half years, and an extension to the 2.2-mile starter line is already in the works.

Digital kiosks along the line display local attractions, take visitors' pictures, and measure air quality. Responsive traffic lights have reduced vehicle transit time along the route by an average of 36 seconds, which cuts down on greenhouse gas emissions by lowering the time cars idle at red lights. The city has also used data collected by sensors on streetlights to predict where potholes will form. Kansas City Chief Innovation Officer Bob Bennett says a successful smart city exists without most people noticing: "Things just work like they ought to work." —LISA RODRIGUEZ

PHOTOS (FROM TOP): MICHAEL SHAKE, ALAMY STOCK PHOTO; KANSAS CITY STREETCAR AUTHORITY; BOB O'CONNOR

ADAPT OR DIE

HOSTILE PLANET

HOSTED BY **BEAR GRYLLS**

EVENT SERIES

MONDAY APRIL 1 9/8c



IF YOU ARE OR WERE A HOLDER OF OR OTHERWISE CLAIM ANY ENTITLEMENT TO ANY PAYMENT IN CONNECTION WITH ANY AMERICAN DEPOSITARY SHARE (SOMETIMES KNOWN AS AN AMERICAN DEPOSITARY RECEIPT) ("ADR") FOR WHICH THE BANK OF NEW YORK MELLON ("BNYM") ACTED AS DEPOSITARY, YOUR RIGHTS MAY BE AFFECTED.

Pursuant to Federal Rule of Civil Procedure 23 and Court Order, the Court has directed notice of the $72.5 million settlement proposed in *In re: The Bank of New York Mellon ADR FX Litigation*, No. 16-CV-00212-JPO-JLC (S.D.N.Y.) to the Settlement Class. If approved, the settlement will resolve all claims in the litigation. **This notice provides basic information. It is important that you review the detailed notice ("Notice") found at the website below.**

What is this lawsuit about:

Lead Plaintiffs allege that, during the relevant time period, BNYM systematically deducted impermissible fees for conducting foreign exchange from dividends and/or cash distributions issued by foreign companies, and owed to ADR holders. BNYM has denied, and continues to deny, any wrongdoing or liability whatsoever.

Who is a Settlement Class Member:

All entities and individuals who at any time from January 1, 1997 through January 17, 2019 held (directly or indirectly, registered or beneficially), or otherwise claim any entitlement to any payment (whether a dividend, rights offering, interest on capital, sale of shares, or other distribution) in connection with, any ADR for which BNYM acted as the depositary sponsored by an issuer that is identified in the Appendix to the Notice. Certain entities and individuals are excluded from the definition of the Settlement Class as set forth in the Notice.

What are the benefits:

If the Court approves the settlement, the proceeds, after deduction of Court-approved notice and administration costs, attorneys' fees and expenses, and any applicable taxes, will be distributed pursuant to the Plan of Allocation set forth in the Notice, or other plan approved by the Court.

What are my rights:

If you receive/have received a Post-Card Notice in the mail, you are a Registered Holder (i.e., you hold (or held) your eligible ADRs directly and your relevant information was provided by BNYM's transfer agent), and you *do not* have to take any action to be eligible for a settlement payment. If you do not receive/have not received a Post-Card Notice in the mail, you are a Non-Registered Holder and you *must submit* a Claim Form, ***postmarked (if mailed), or online, by August 15, 2019***, to be eligible for a settlement payment. Non-Registered Holder Settlement Class Members who do nothing will not receive a payment, but will be bound by all Court decisions.

If you are a Settlement Class Member and do not want to remain in the Settlement Class, you may exclude yourself by request, ***received by May 13, 2019***, in accordance with the Notice. If you exclude yourself, you will *not* be bound by any Court decisions in this litigation and you will *not receive a payment*, but you will retain any right you may have to pursue your own litigation at your own expense concerning the settled claims. Objections to the settlement, Plan of Allocation, or request for attorneys' fees and expenses must be ***received by May 13, 2019***, in accordance with the Notice.

A hearing will be held on **June 17, 2019 at 3:00 p.m.**, before the Honorable J. Paul Oetken, at the Thurgood Marshall U.S. Courthouse, 40 Foley Square, New York, NY 10007, to determine if the settlement, Plan of Allocation, and/or request for fees and expenses should be approved. Supporting papers will be posted on the website once filed.

For more information visit www.bnymadrfxsettlement.com, email info@bnymadrfxsettlement.com or call 866-447-6210.

866-447-6210
www.bnymadrfxsettlement.com

LEGAL NOTICE

IF YOU PURCHASED CERTAIN MORNING SONG WILD BIRD FOOD PRODUCTS FROM NOVEMBER 2005 TO MAY 2008, YOU MAY BE ENTITLED TO PAYMENT FROM A PROPOSED CLASS ACTION SETTLEMENT.

A proposed Settlement has been reached in a class action lawsuit about certain Morning Song wild bird food products that were purchased between November 2005 and May 2008. The plaintiffs allege that the application of two pesticides, Storcide II and Actellic 5E, to certain wild bird food products and the sale of those products violated the law. The plaintiffs sought refunds for their purchases. The defendants, The Scotts Miracle-Gro Company, The Scotts Company LLC, and Scotts' Chief Executive Officer, deny any wrongdoing and deny that the plaintiffs suffered any damages or that they are entitled to refunds. The Court has not decided which side is right, but the parties have elected to settle the dispute by agreement.

What Are The Settlement Terms? The proposed Settlement provides for the payment of up to $85,000,000 in cash from which eligible consumers may receive refunds for their qualifying purchases of Morning Song Bird Food. Retailer-Identified Refunds will be provided automatically to Settlement Class Members who can be identified through certain retailer records. Settlement Class Members who cannot be identified through those retailer records must submit a Claim Form for a refund. A Settlement Class Member who submits a Claim Form with Proof of Purchase will receive a full refund. Claim Forms submitted without proof of purchase may receive up to $100 per household or more, depending on the amount of the claims and the balance available for distribution.

How Do I Get A Payment? Settlement Class Members who do not receive a "Retailer-Identified Refund Notice" by mail or email must submit a Claim Form by **July 1, 2019**. Claim Forms may be submitted online or printed from the website and mailed to the address on the Claim Form. Claim Forms are also available by calling 1-866-459-1390.

Your Other Options. If you do nothing, your rights will be affected but you will not receive a Settlement payment unless you are eligible for a Retailer-Identified Refund. If you do not want to be legally bound by the Settlement, you must exclude yourself by **May 13, 2019**. Unless you exclude yourself, you will not be able to sue Scotts or any of the Released Defendants for any and all of the legal and factual issues that the Settlement resolves and the Settlement Agreement releases. If you exclude yourself, you cannot receive a Refund under the Settlement. If you do not exclude yourself, you may object to the Settlement and notify the Court that you or your lawyer intend to appear at the Court's final approval hearing. Any objection to the Settlement, or the fee and expenses application, are due ***no later than* May 13, 2019**: Rachel L. Jensen, Robbins Geller Rudman & Dowd LLP, 655 West Broadway, Suite 1900, San Diego, CA 92101; Edward Patrick Swan, Jr., Jones Day, 4655 Executive Drive, Suite 1500, San Diego, CA 92121-3134; and Mark Holscher, Kirkland & Ellis LLP, 333 South Hope Street, Los Angeles, CA 90071.

The Court will hold a hearing in this case (*In re Morning Song Bird Food Litig*., No 3:12-cv-01592) at 2:30 p.m. on June 3, 2019 at the U.S. District Court for the Southern District of California, 333 West Broadway, San Diego, California 92101, for the purpose of determining: (i) whether the proposed Settlement of the claims in this litigation should be approved by the Court as fair, reasonable and adequate; (ii) whether a final judgment and order of dismissal with prejudice should be entered by the Court dismissing the litigation with prejudice; and (iii) whether Class Counsel's application for the payment of attorneys' fees and expenses and service awards for the four named plaintiffs should be approved. You do not need to appear at the hearing or hire your own attorney, although you have the right to do so at your own expense.

This Notice is just a summary. Complete details, the Long-Form Notice, and Settlement Agreement are available at www.birdfoodsettlement.com or by calling 1-866-459-1390.



RECREATION

COPENHAGEN'S MOUNTAIN OF ENERGY

WHERE TRASH IS BURNED AND POWDER IS SHRED

With its flat landscape, Copenhagen is an unlikely ski destination. But a novel project called Copenhill aims to pair recreation with renewable energy. Copenhill is a massive facility on the city's industrial waterfront that converts trash to electricity, providing power for 30,000 homes and heat for more than twice that number. Its sloping, 1,247-foot-long roof looks like it was made for skiing—because it is. The new structure will eventually include an urban ski park, a climbing wall, and a café with sweeping city views.

The plant is 25 percent more efficient than the previous waste-incineration facility and will capture its carbon dioxide emissions, in line with Denmark's ambitious goal to become carbon-neutral by 2050. The idea of burning garbage has its critics, who say waste-to-energy plants merely reinforce wasteful consumerism. But in 2018 Copenhill processed almost 500,000 tons of garbage. That's better than filling up landfills, which are potent sources of methane—a greenhouse gas that can ruin the prospect of anyone's powder day. —CHRISTINA NUNEZ

WATER

New Way to Keep City Water Clean

Some sea anemones extend their tentacles to catch a meal. At other times, they retract them. Researchers looking to simplify water treatment took this ability to change shape as inspiration for a new type of nanocoagulant. When added to water, the nanocoagulant exposes its core, which interacts with unwanted chemicals such as nitrate and other aquatic contaminants. Its shell causes particles to clump together and settle to the bottom.


—DOUGLAS MAIN





Edible Waste

Researchers at Russia's Samara State Technical University have created cups out of pureed fruits and vegetables. Shaped using a plasticizer, the all-natural dishware is durable enough to contain boiling water—and you can eat it (it tastes like the original produce). While the project was initially aimed at reducing food-packaging waste for astronauts, it would be a useful addition to city kitchens—or any place seeking to reduce landfills. —BECKY DAVIS

PHOTOS (FROM TOP): BJARKE INGELS GROUP; HUAZHANG ZHAO; EVGENY NEKTARKIN, SAMARA POLYTECH





Crowds flock to Omotesando, a busy shopping street in Tokyo, heart of the world's most populous metropolitan area. Home to more than 37 million people, Tokyo is one of the safest, cleanest, most dynamic, and most innovative cities.

NEXT PHOTO

Tokyo has been rebuilt twice during the past century—first after the 1923 Great Kanto earthquake and again after the city was bombed in World War II. Since then the city has grown into a model of efficiency and organization, where even a construction site in the Minowa neighborhood is monitored by blue-suited security guards who courteously guide pedestrians and cyclists around it.

BY

NEIL SHEA

WALKING TOKYO

PHOTOGRAPHS BY

DAVID GUTTENFELDER

A JOURNEY THROUGH THE RICH TEXTURES OF JAPAN'S VIBRANT, REINVENTED MEGACITY




Park station
24 hours
8:00~20:00
20分/100円
24時間 最大
20:00~8:00
60分/100円
夜間最大
(20:00~8:00)
どこよりもあなたの
土地を高く借り上げます
JOY FIT
GYM 24
ジョナサン
24h
ヴィトン
質
ながさわ
車両通
みのわ接骨院



An early summer Saturday draws young families to Yoyogi Park. The scene belies a looming challenge in Japan, where deaths outnumber births and the population is aging rapidly. By 2035 more than a quarter of Tokyo's population will be over 65.











EARLY ON A COLD JUNE MORNING, I stood in darkness near the west bank of Tokyo's Sumida River, watching tourists pull on bright nylon vests. They were green and glaring yellow, the sort of thing you'd wear in a pickup soccer game, as though the 70 shivering visitors from South Africa, China, Malaysia, Spain, and Russia had traveled all that way to chase balls along the gritty waterfront. ¶ It was an hour or two before dawn, and we were actually suiting up for a tour of Tsukiji Shijo, which at the time was the largest fish market in the world. Tsukiji was a labyrinth of warehouses, freezers, loading docks, auction blocks, and vendor stalls, and it had fed the city for nearly a century. It had also become—to the dismay of some who worked there—an attraction, promoted in countless articles and cable cooking shows. ¶ When I visited last year, though, the historic market was nearing the end of its run. The breezy stalls and cracked cobblestone floors lured tourists seeking authenticity, but in hypermodern Tokyo such things were officially seen as an unsanitary part of the unruly past. By autumn Tsukiji



1. A man feeds birds in Ueno Park. **2.** Greenery decorates the entrance to the Shiodome subway station. **3.** Figurines of the Tokyo Tower mascots stand outside the tower. **4.** Corporate subway commuters ride the Toei Oedo Line. **5.** Outside a Shibuya drugstore, a stand-in photo board of an apprentice geisha in traditional costume waits for someone to fill its face cutout. **6.** In western Tokyo Prefecture a farmer produces rice for the coming year. **7.** A man rests near his traditional sandals during a festival in Negishi. **8.** Apricots sit along the railing outside a pavilion at Shinjuku Gyoen National Garden. **9.** A Buddhist statue of Jizo Bosatsu, protector of children, is surrounded by offerings in the residential area of Katsushika.

would close, its vendors moving from the heart of the city to a new, bland-looking facility to the southeast.

We queued up to march inside. Fish scales glittered in puddles at our feet and the air tasted of oil and low tide. Forklifts and rattling ice carts flew past in all directions, like panicked birds. I realized our mesh vests were partly for safety—so we wouldn't get squashed in the traffic—but also so we couldn't sneak off and gum up Tsukiji's lucrative flow.

Each day, some 1,600 tons of fish, sea plants, and squirming invertebrates from all over the world poured into the market. At day's end, that incredible haul, worth about $15 million, had been sorted, sawed into pieces, and shipped to retailers. By the time I'd arrived, at 4:30 a.m., the market had been roaring for hours.

Hundreds of men hustled through the haze, laughing and shouting, cigarettes clamped between their teeth. White-gloved security guards directed us past a heap of Styrofoam boxes, some as big as coffins, their insides streaked with blood. Ahead, in a cavernous warehouse, saw blades screamed as they tore into frozen fish flesh.

Most of the tourists had come for the famed tuna auctions, where giant fish from as far away as coastal Maine were sometimes sold for hundreds of thousands of dollars. But compared to the circus we'd just walked through, the auction, when we saw it, was a yawn—a bunch of quiet guys quietly bidding up the price of high-end meals in Tokyo, Moscow, New York City.

By 10 a.m. the action had ebbed and I slipped through the market alone, speaking with fishmongers who lamented the old market's looming closure. Several hours later, only the delivery trucks still hummed, the drivers lounging in their cabs while forklifts packed fish into holds.

Near midnight I wandered out to a small Shinto shrine where a row of stone monuments honored several species of edible sea creatures. Tsukiji had been Gothic, thrilling, obscene—a rare spot where Tokyo's sleek modern facade fell away to reveal raw appetite—and I was exhausted.

A cat brushed past my feet. The stone before me read *sushi-zuka,* "the monument to sushi." In a few hours it would all begin again.

IF YOU AGREE with Harvard economist Edward Glaeser that cities are humanity's greatest invention, then Tokyo is perhaps our greatest example: a stunning metropolis, home to more than 37 million people and one of the world's wealthiest, safest, most creative urban centers.

Even if you're not particularly interested in how megacities shape human behavior, Tokyo is unavoidable—it has already changed your life. The city is the ultimate social influencer, the node through which the world connects to Japanese culture.

Tokyo is there in your morning matcha latte, your afternoon bowl of miso, that dinner of sushi. You find it in your kid's fascination with Totoro, Gundam, Pokémon, or Sony PlayStation 4. And it's in the tiny cell phone camera you both can't stop using.

The city's creativity can be traced, in part, to the fact that it's been razed twice in the past 100 years—first by the Great Kanto earthquake of 1923, and a generation later by U.S. bombing raids during World War II. Each catastrophe forced the Japanese to bury history and rebuild, reimagining neighborhoods, transportation systems, infrastructure, even social dynamics. Tsukiji market itself was built in the aftermath of the Kanto quake, to replace one that had stood near the center of the city for 300 years.

In the 1950s, Tokyo rebounded and grew incredibly dense. Glaeser suggests this is a reason for its success: the creative agitation that follows from cramming together people of diverse ages and backgrounds and stripping away barriers to trade and ideas. In an issue dedicated to cities, we couldn't ignore Tokyo. And the writer Jane Jacobs, a major influence on urban planning, said that the best way to know a city, to feel its mashed-up power, is to walk it.

So photographer David Guttenfelder and I did. For weeks we crossed and recrossed Tokyo, sometimes together, often apart; sometimes in a straight line, often leapfrogging from one area to another, working slowly through neighborhoods and industrial areas, school campuses, train stations, markets, graveyards, temples, and shrines. We had both lived previously in Japan, and we knew Tokyo could be buried beneath the superlatives used to describe it. We talked with nearly everyone we met, documented slivers of their routines and rituals. We couldn't be comprehensive. But we could try to see more deeply, linking the city to the people who through their lives give it power.

SUGAMO

A SPIRITED NEIGHBORHOOD FOR SENIORS

SOME THINGS HADN'T CHANGED in 20 years. Police patrolled neighborhoods on white bicycles; kids barely bigger than their backpacks safely rode the subways alone. And most Tokyoites still live in Morse code rhythms, dashing between work and home on superefficient train lines. Just glancing at a map of the transit system conjures a diagram of neurons in the human brain. New York, where I live, has more stations, but each day some 10 million people ride Tokyo's subways, more than New York City's entire population.

On a clear Saturday morning, I walked through Hachiyamacho, Uguisudanicho, and Ebisunishi, caught a Yamanote Line train at Shibuya, and took it to Ikebukuro, where I got out and kept walking. In the northern neighborhood of Sugamo, clerks were wrestling tables and clothing racks out onto the pavement along Jizo-dori, hoping to lure customers from a stream of mostly elderly, female pedestrians. There were sweaters for sale and necklaces, kitchen goods, orthopedic devices, canes, knee braces, adult diapers. But it was the underwear that stood out—bright red briefs and panties, neatly packaged, arranged by size.

In Japanese culture, red is associated with good luck, good health, longevity.

Older women in twos and threes strolled along, pulling through the racks, pausing here and there to tug at a waistband, check a price, buy a pair. Younger people flitted past the stands or slipped into a nearby coffee shop, but the crowd was mostly elderly, *ojii-sans* and *obaa-sans,* grandfathers and grandmothers.

Cities often talk about themselves in terms of life, growth, youth—but old age and death are always there too, even when they're largely ignored or treated as a matter of dull housekeeping. Harvard anthropologist Ted Bestor had pointed me toward Sugamo because here death is close to being on display. The neighborhood reveals a defining feature of Tokyo: its enormous, rapidly increasing elderly population.

"In Tokyo they don't try to hide the old people away," Bestor said. "It can't be done. There are just too many of them. So the old folks have their own district; they make their own fun."

Birth rates in most prosperous industrialized nations have declined substantially, but Japan is the most elderly of all. Nearly 30 percent of its population of 126 million is over 65. Deaths outnumber births. And while Tokyo is graying slightly less rapidly than the rest of the nation, its share of the burden will be enormous, leaving the city scrambling to decide how it will care for, pay for, and house the generations that built it.

Aging is expected to drain the economy. But there's a psychic cost too, illustrated most dramatically by *kodokushi,* a phenomenon often translated as "lonely death," in which a person dies and remains undiscovered for days or weeks. By 2035 more than one-quarter of Tokyo will be over 65, and many of those people will live alone.

In Sugamo, though, there was no sense of gloom or hopelessness. The crowd shopping for end-of-life care and crimson thongs flowed easily along Jizo-dori, laughing, arguing, shouting into mobile phones. Outside one shop a man and a woman gazed into the window, talking of robots. The Japanese government, which faces a labor shortage along with the aging problem, is subsidizing the development of robotic caregivers.

"Can we buy one to take care of you yet?" he said gently. Beside him stood the elegant older woman wearing a wide-brimmed hat against the morning sun.

"You're stuck with me," she said. "Those things are too scary."

SENDAGAYA

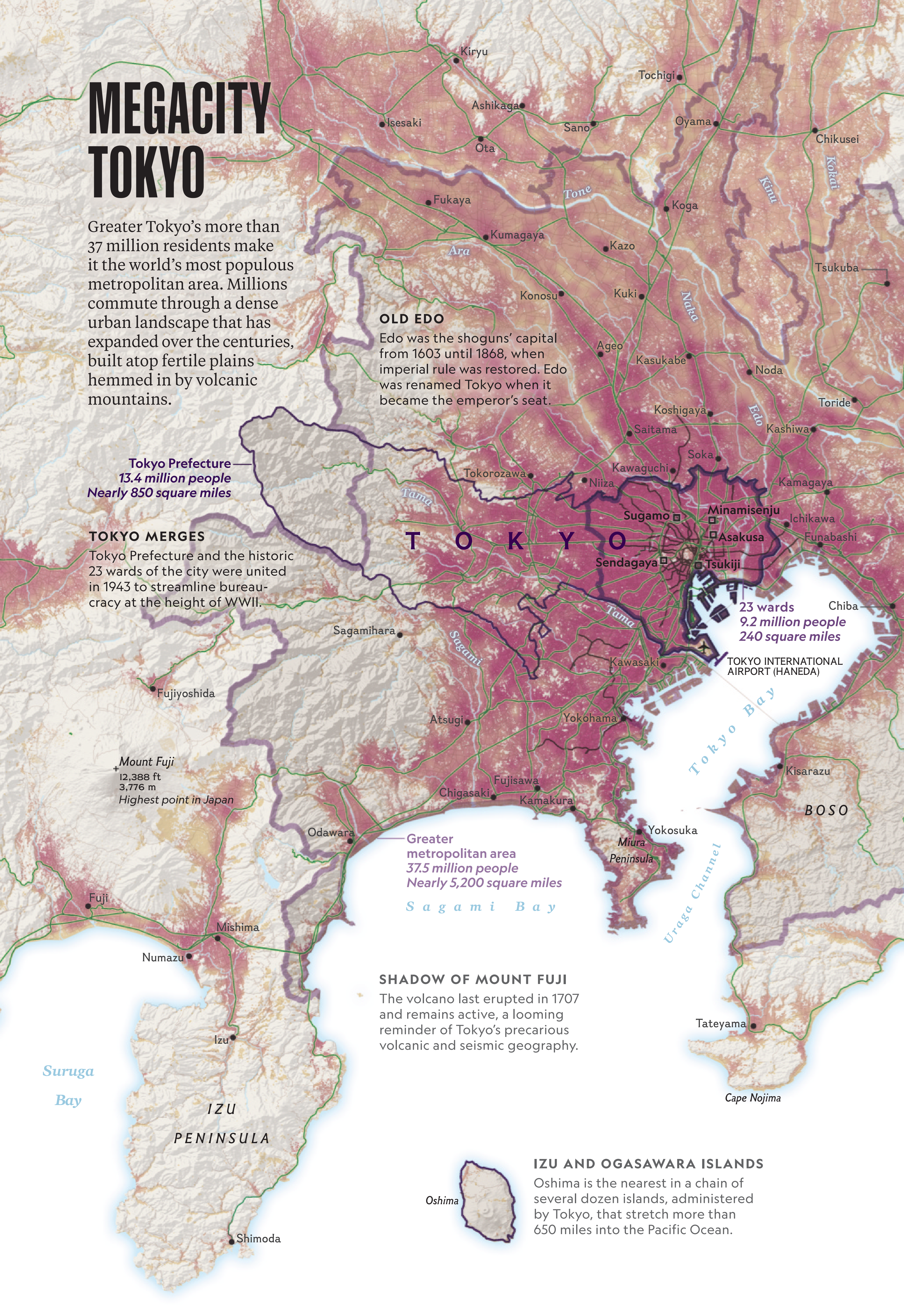
A SLICE OF SILICON VALLEY IN TOKYO

MASANORI MORISHITA IS TALL and thin, his dark hair thick and wild. He seems to vibrate, in the way of people driven by a slightly faster internal clock. Morishita is a serial tech entrepreneur and had recently sold his start-up, Everforth, to a larger technology company for a sizable sum. After the sale he stayed on to develop his product, and on the day I met him in the west-central neighborhood of Sendagaya, he was doing his best to fulfill another role: that of a visionary


SAKE
なまびーる
陵 本店



Yakitori restaurants and pubs called *izakaya* are squeezed in beneath a train line in the bustling Yurakucho neighborhood. Many of Tokyo's entertainment districts rely on traditions from Japanese office culture, in which *nomikai,* after-work drinking parties, are common.



MEGACITY
TOKYO
Greater Tokyo's more than 37 million residents make it the world's most populous metropolitan area. Millions commute through a dense urban landscape that has expanded over the centuries, built atop fertile plains hemmed in by volcanic mountains.
OLD EDO
Edo was the shoguns' capital from 1603 until 1868, when imperial rule was restored. Edo was renamed Tokyo when it became the emperor's seat.
Tokyo Prefecture
13.4 million people
Nearly 850 square miles
TOKYO MERGES
Tokyo Prefecture and the historic 23 wards of the city were united in 1943 to streamline bureaucracy at the height of WWII.
T O K Y O
23 wards
9.2 million people
240 square miles
TOKYO INTERNATIONAL AIRPORT (HANEDA)
Greater metropolitan area
37.5 million people
Nearly 5,200 square miles
Mount Fuji
12,388 ft
3,776 m
Highest point in Japan
SHADOW OF MOUNT FUJI
The volcano last erupted in 1707 and remains active, a looming reminder of Tokyo's precarious volcanic and seismic geography.
IZU AND OGASAWARA ISLANDS
Oshima is the nearest in a chain of several dozen islands, administered by Tokyo, that stretch more than 650 miles into the Pacific Ocean.
Kiryu
Tochigi
Ashikaga
Isesaki
Sano
Oyama
Chikusei
Ota
Tone
Kinu
Kokai
Fukaya
Koga
Kumagaya
Ara
Kazo
Tsukuba
Konosu
Kuki
Naka
Ageo
Kasukabe
Noda
Toride
Koshigaya
Edo
Saitama
Kashiwa
Soka
Kawaguchi
Tokorozawa
Niiza
Kamagaya
Tama
Sugamo
Minamisenju
Ichikawa
Asakusa
Funabashi
Sendagaya
Tsukiji
Chiba
Sagamihara
Sagami
Kawasaki
Fujiyoshida
Atsugi
Yokohama
Tokyo Bay
Kisarazu
Fujisawa
Chigasaki
Kamakura
BOSO
Odawara
Yokosuka
Miura Peninsula
Uraga Channel
Sagami Bay
Fuji
Mishima
Numazu
Tateyama
Izu
Suruga Bay
Cape Nojima
IZU PENINSULA
Oshima
Shimoda

Hitachinaka
Mito
Kasama
Ishioka
Hokota
Lake Kasumigaura
ASIA
JAPAN
Tokyo
MAP AREA
PACIFIC OCEAN
PACIFIC OCEAN
Tone
NARITA INTERNATIONAL AIRPORT
Sakura
Choshi
Cape Inubo
Mobara
PENINSULA
Isumi

COMMUTING EN MASSE

Some 3,000 miles of rail lines in the metro area transport commuters. The subway systems carry 10 million each day.

Tokyo boundaries

- Tokyo Prefecture
- Perimeter of historic 23 wards
- Greater metropolitan area

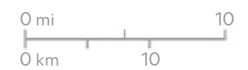
Commuter and regional connections

- Subway
- Railroad
- Featured neighborhood

Population density in built-up area

Lower — Higher

People per square mile: New York City 28,450; 23 wards 38,500

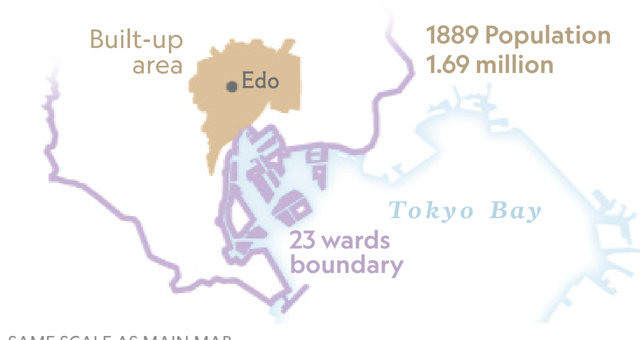


MATTHEW W. CHWASTYK, NGM STAFF. SOURCES: TOKYO METROPOLITAN GOVERNMENT; E-STAT, NATIONAL STATISTICS CENTER, JAPAN; UN WORLD URBANIZATION PROSPECTS 2018; ATLAS OF URBAN EXPANSION, NEW YORK UNIVERSITY; LANDSAT 8, NASA AND USGS; NATIONAL ARCHIVES OF JAPAN; ROAD AND RAILROAD DATA ©OPENSTREETMAP CONTRIBUTORS, AVAILABLE UNDER OPEN DATABASE LICENSE: *OPENSTREETMAP.ORG/COPYRIGHT*

A HISTORY OF DISASTER AND RECOVERY

TOKYO BECOMES AN INCORPORATED CITY

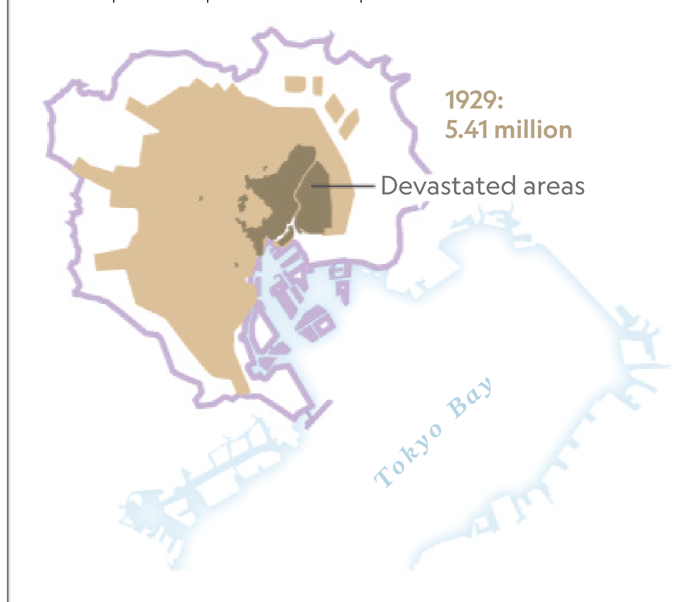
Tokyo is formally created in 1889 with 15 wards centered on what was once a small fishing village called Edo, meaning estuary.



SAME SCALE AS MAIN MAP; PRESENT-DAY COASTLINES SHOWN

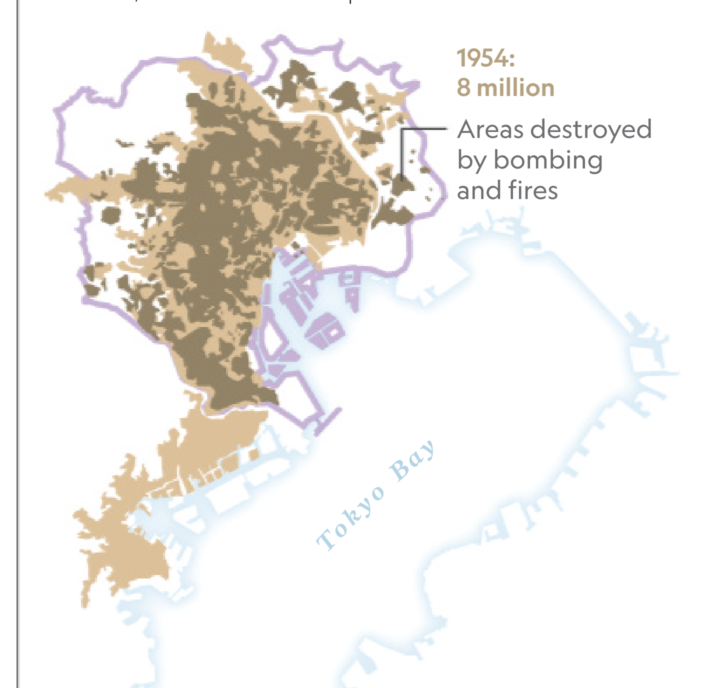
GREAT KANTO EARTHQUAKE

A 1923 quake destroys some 300,000 structures and kills more than 100,000 people. Development spreads in the plains to the west.



WARTIME DAMAGE AND RECONSTRUCTION

U.S. bombing raids in WWII lay waste to many of the area's wooden buildings. Tokyo rebuilds, and urbanization pushes southward.





1. A large public housing project, or *danchi,* rises up in Itabashi. **2.** Tourists in Yurakucho, each dressed as a character from a video game or film, cruise the city on go-karts. **3.** Tourists visit one of the world's largest underground floodwater-diversion facilities, on the outskirts of Tokyo. **4.** An owl perches inside a small owl café in Harajuku. **5.** A train commuter checks his phone. **6.** A couple relaxes in Yoyogi Park. **7.** Pedestrians and shoppers stroll on Chuo-dori in Ginza. **8.** A Buddhist priest prays at the Koukokuji Temple, a columbarium containing more than 2,000 LED-lit Buddha statues. **9.** A woman wears pink shoes shaped like paws in Akihabara Electric Town, a neighborhood known for electronics shops and manga boutiques.







30-something CEO who was relaxed enough to throw a barbecue for the company.

It was held at Morishita's new home, a narrow four-story stand-alone structure in a small cluster of houses near an old graveyard. Morishita had leased the home with plans to transform it into a live-work space where his engineers, sales team, and others could collaborate elbow to elbow. Offices were outfitted with whiteboards; there were bedrooms for employees, plus a wine cellar and a library, its shelves mostly bare.

On the roof, Morishita flipped chicken over glowing coals (he had made the dressing for the salad himself) and outlined his plan to undermine traditional Japanese values with tech-inspired ones. It began with his house.

"I like Silicon Valley culture," Morishita said. "I'm trying to do that here, but it's difficult."

He waved his tongs at the city.

"Japanese culture, you know, it's very strict. Ordered. Organized. People like to be told what to do." The house, he said, and the new ways of living and working that it embodied were revolutionary.

We looked at the skyline to the east, where cranes rose over the site of Japan's new national stadium in the adjacent neighborhood of Kasumigaokamachi. It is the centerpiece of Tokyo's redevelopment effort for the 2020 Summer Olympics and will seat 68,000 spectators for the event.

The quiet neighborhood could be transformed by the nearness of the stadium, but Morishita was unconcerned. He was busy unplugging his work from the physical and social infrastructure that had held Tokyo together for decades—the crowded trains and roads, the obligatory after-work drinking parties, the stringent traditions that had, in his mind, prevented Japan from truly developing a Silicon Valley of its own.

"What I really want is freedom," Morishita said.



ASAKUSA

A NEW TYPE OF URBAN DESIGN'

A FEW WEEKS LATER, in a neighborhood called Asakusa on the other side of the city, I met with Kengo Kuma, the architect who designed the new national stadium. Kuma, one of Japan's



leading talents, is older by a generation than Morishita, but the two share a fundamental desire to remake the city.

We sat in a small room on the third floor of the Asakusa Culture Tourist Information Center, which, like nearly all the buildings Kuma has designed, is both hypermodern and surfaced in natural materials, in this case wood—a combination intended to lend warmth and presence while also paying homage to traditional Japanese craftsmanship.

It was a hot, humid day, and I wanted to talk about the density I had been walking through. Kuma is sometimes taken for an anti-urbanist—opposed to the mass and hardness of cities—but he was quick to reject that label.

"People say I'm a critic of cities," he said, shaking his head. "I want to reshape the city. I want



In Shinjuku's Golden Gai, an entertainment district lined with hundreds of tiny bars, Tokyoites and tourists belt out karaoke favorites deep into the night. The small alleyways hold one of the densest entertainment districts on the globe, and karaoke—invented in another city—remains one of Japan's most popular pastimes.

to break space up and return things to a smaller scale." That smaller scale, he said, was once a defining feature of Japanese life, and would allow for more trees, gardens, parks—and more human connections.

Kuma has designed hundreds of structures across Japan and in other countries, and I might have crossed Tokyo simply by neighborhoods that contain his work—an elegant udon restaurant fitted inside an old fireproof warehouse, a university computing center sheathed in cedar shingles, a cake shop covered with a lattice of timber that's meant to suggest a forest.

Of course the massive oval stadium will likely define him to future generations. But even that wears Kuma's vision—a future in which structures are built for multiple uses over their lifetime and sit lightly on the landscape. After the Olympics his stadium will be converted for use as a soccer arena. It will sit in a grove of trees, and its several floors will be ringed with more greenery, planted around open-air walkways. The stadium's roof is also open, allowing natural light to flood its interior.

"We do have a density problem," Kuma said. "Our urban design up until now was to find land and put a huge building on it ... Destroying everything to make way for skyscrapers and shopping centers—that has been the method in Asia."

Density intensified after the Kanto earthquake, he explained, and it increased again after the destruction of World War II. Many of the world's great cities are ancient accretions, three-dimensional records of human behavior built up over centuries. But contemporary Tokyo was built quickly and haphazardly, its buildings, highways, and train lines pushed into blanks created by bombs and fire.

The consequences, Kuma said, are revealed in some of Tokyo's darkest contemporary problems, including kodokushi, the lonely death. He reached out and tapped a concrete pillar beside him.

"My students prefer to live in shared houses now. That's new ... That kind of lifestyle was abandoned after the war. We've been living in isolated spaces, separated by concrete. People don't want to do that. They know it's bad for them."

Kuma was animated, sketching with his hands as he described Tokyo. Many ideas he supports, from environmental sustainability to programs aimed at "returning nature to the city," have slowly gained ground. When we later climbed to the tourist information center's rooftop





A worker at Tokyo's Tsukiji market arranges frozen tuna before a morning auction. Crosscut tail sections allow buyers to evaluate the quality of each fish. Before it moved to a larger site last October, Tsukiji was already the world's biggest fish market.


Life is
Your Life
橋本ビル
SAPIX
東進
ハイスクール
NSW
IoTで未来を…
日本経済大学
大学院



Tokyo has a shortage of service workers and laborers like these, who start each day with calisthenics at a construction site in Shibuya. Japan has resisted immigration, but last year lawmakers eased its immigration policy to attract foreign workers.

observation deck, Kuma described Japan as a "mature society"—wealthy, technologically advanced, and aging. Ready, in other words, to grow more responsibly.

"The best thing we can do," he said, "is setan example ... We can show how to do things differently."

The roof was packed with tourists photographing Tokyo's skyline or gazing down over Senso-ji, a sprawling Buddhist temple complex that is no less superlative than the city itself; millions of pilgrims and tourists visit each year. Scents of sunblock, sweat, and incense rose up through the languid air.

We watched crowds pouring into the temple through Kaminarimon, the "thunder gate," just across the street. To the east a short dark building squatted on the opposite bank of the Sumida River. Part of Asahi Breweries' world headquarters, it's topped with an enormous golden plume that is said to represent a flame. A lot of people just call it "the golden turd." Kuma grimaced. Every building has a life, he said, and we should strive to be in harmony with it. "The position of [this one] is very important in front of the Kaminarimon gate. In designing it I want to show respect to the gate, the street .... Many people think history is history. Well, we live in a different age, but we're still speaking with the past."

MINAMISENJU

WHERE THEY SUFFER TO BRING LUCK

TOSHIO TAJIMA SAT on the steps of the Shinto shrine in Minamisenju, a gritty neighborhood in east-central Tokyo, watching for his team of spirit-movers. It was a warm Friday in June, festival time, and traditional music—flutes, strings, drums—was blaring from loudspeakers mounted on telephone poles. Tajima, a large and serious man, was annoyed. Some 200 men were supposed to gather beneath the tall ginkgoes in the quiet courtyard, but only a dozen or so had showed and the local spirit, a deity named Susanoo, the storm god, was being made to wait.

Tajima and the others were dressed traditionally and for teamwork, in identical *happi* jackets made of light cotton and wearing white *jika-tabi,* the split-toed shoes of the Japanese laborer. In anticipation of hard work, most also wore shorts, though a few guys had opted to gird their loins in a traditional *fundoshi,* a sort of jockstrap crossed with a thong.

In one hand Tajima held a megaphone. The other he balled into a fist. He had short dark hair, a neat mustache, and a white bandanna knotted around his head. When he finally stood, out of restlessness, I noticed a weird lump at the back of his neck. It jiggled. Tajima caught me staring, and he tapped the lump. It jiggled some more.

"That's my *mikoshi-dako,"* he said, obviously proud.

An older man stepped over and admired it.

"It's a huge one!" he said. Then he half-turned and pointed to his own slightly smaller lump. "Only dedicated men get these."

I'd never heard of a mikoshi-dako. Tajima explained that the word combines the terms for the portable shrine and "calluses," though the lumps were nothing like any calluses I'd ever seen. They were squishy. A little gross. As I tried to imagine what could possibly cause them, the older man, Teruhiko Kurihara, laughed and pointed toward what looked like an oversize dollhouse set atop long, thick rails.

"That's the mikoshi," he said. "You get the dako from carrying it." He gave his callus a happy slap.

The mikoshi was almost as big as a Mini Cooper, decked in gold hardware, sheathed in black and red lacquer. Paper screens filled the miniature windows, and hand-carved posts stood before hand-carved doors below a steeply pitched roof. It was a near replica of the actual shrine behind us, scaled down to portable dimensions. Every neighborhood in the area has its own portable mikoshi, and for the festival, Shinto priests had ceremonially transferred each neighborhood's deity into their mikoshi.

Soon about 40 men had arrived, all in identical outfits, and Tajima decided it was enough to get things moving. They gathered around the mikoshi and placed their hands on the smooth rails. At Tajima's command they bent their knees, braced their shoulders, and lifted.

Such festivals are common in Japan, and that afternoon I'd already seen other teams ferrying mikoshi down the streets, blocking traffic, pausing now and then for beer and snacks. For several days the mikoshi would float through

their respective neighborhoods in a communal ritual meant to bring good luck and refresh ancient faith. On the last day—the big day—all the mikoshi would be hauled back to the local shrine. There'd be a huge party, Susanoo and the other spirits would be returned, and people would literally limp home.

The mikoshi in front of Tajima wobbled upward onto the shoulders of its devotees, and they moved it across the courtyard, marching in practiced unison. When they reached a certain sacred spot, the procession stopped. Tajima yelled instructions, and the mikoshi began to rock, a gentle swaying at first, the men chanting and pushing. But slowly the shrine picked up momentum, and suddenly it was hurtling toward the ground, the men underneath certain to be crushed—until disaster was somehow averted and the shrine was thrown over to its other side. Back and forth it went, again and again, the shrine tossed like a boat on a seriously angry sea, battering necks and shoulders below.

Tajima laughed at each near wreck. "Faster!" he shouted.

Beneath the shrine, men grinned and groaned and heaved; the gravel at their feet grew dark with sweat.

At my shoulder Kurihara said, "Our god likes it rough!" Then he asked, "Want to try?"

He tapped a man out; I slipped in. Even with the entire team beside me, the burden felt personal. The mikoshi bit into my spine. It was easily a thousand pounds of bone-crushing wood, gold, and lacquer, and it punched me downward like a fence post. After a few minutes I had an apple-size bruise over my cervical vertebrae that would ache for a week. Kurihara tapped me out. I felt several inches shorter.

"What's inside that thing?" I said.

Kurihara shrugged. He owned a nearby flower shop and had shared the suffering and joy of this tradition with his neighbors for more than 20 years.

"It's the spirit," he said. "It's really heavy."

Tajima's team marched out of the courtyard and onto the streets of Minamisenju. White-gloved policemen held up traffic. Soon a crowd had gathered around the shrine, spilling out of homes and shops, people shouting support or jumping in for a turn. Every few minutes they would stop and shake the shrine, building momentum until it nearly toppled and dozens of hands reached up to stop the fall.



CHUO

IN CITY'S HEART, A CALL FOR DIVERSITY

TOKYO PREFECTURE'S GOVERNOR, Yuriko Koike, admitted that she sometimes misses chaos.

Koike, Tokyo's first female governor, attended university in another massive metropolis—Cairo. It's hard to imagine two places more utterly opposed, but for Koike, that was part of the allure.

"What's attractive about Cairo is that it's chaotic," she said, smiling at memories of hectic streets, the ancient souk. "But of course what's attractive about Tokyo is that everything is controlled."

We were walking down a shaded gravel path in the central Hama-rikyu Gardens, a calm refuge of manicured lawns and flower beds with stands of black pines, crape myrtles, and cherry trees flush against the Sumida River.

Koike had once been a news anchor, and she'd leveraged her Cairo experience into interviews with Arab leaders like Yasser Arafat and Muammar Qaddafi. In the 1990s she pivoted to politics and spent 24 years as a member of the national Diet, during which time she served in the cabinets of two prime ministers including serving, briefly, as Japan's first female defense minister. She was elected governor in a landslide in 2016. The decisiveness of her victory suggested that the male monopoly on power might finally be slipping.

Koike, who is often labeled a conservative, has spent much of her tenure fighting, or at least talking about, what she has called Japan's "iron ceiling." In office she has embraced environmental causes and urban sustainability, and like architect Kengo Kuma she seems to sense that Tokyo has reached a point of middle age from where it might begin a second act.

The city is technologically and financially capable, Koike said, of making itself greener and preparing for technical details of future problems like, for example, sea-level rise. But social issues are slipperier.

"What's missing now in Tokyo is diversity," she said. "And one of the pillars of a diverse city is to have more women involved."

Arriving from Brooklyn, I found Tokyo's absence of diversity a regular, striking feature of my journey. Sizable populations of Koreans and Chinese live in Tokyo, and many of those families have been there for generations. The number of "international residents" has also increased over time—in 2018, one in 10 Tokyoites in their 20s were non-Japanese. But in a city so vast, those groups faded quickly, and diversity, whatever its form, remains an awkward subject in Japan.

The nation's rapid reinvention after World War II has often been attributed—by foreigners and Japanese alike—to its perceived homogeneity, a broad belief that Japan is ethnically and linguistically united, that together its people value harmony above all else, with good measures of obedience, loyalty, and self-sacrifice.

These are risky notions, a list of model Asian behaviors perhaps better chalked up to a cartoon samurai. But some Japanese consider them to be sacred and even vulnerable qualities, the sorts of things an influx of outsiders would dilute, or destroy.

Koike herself has been criticized for talking diversity without doing much to enable it. But her election itself was seismic and may yet prove part of a broader shift. The 2020 Olympic Games have provided motivation for Tokyo to move more quickly on diversity, Koike said. After all, tens of thousands of foreigners are expected to visit during the games, offering a chance to show off. And she understands that Tokyo's composition will soon change no matter what. If nothing else, old age guarantees it.

"Our biggest difficulty is how to handle the aging population," she said. "But Tokyo is one of the centers for overcoming great challenges." She adds that "resilience isn't just Tokyo; it's a Japanese characteristic. People are very serious, and they take things seriously."

A cool breeze lifted off the water, pushing away, for a few moments, the heavy damp air and ruffling nearby pines. In the distance, cargo ships blared their horns.

The governor said her day had so far been consumed with the shutdown of Tsukiji market.

There were problems. It was complicated. Just another superlative project in the superlative city.

We walked back across the park to her small white van. Koike has been active in Tokyo for nearly 40 years and is presiding over immense transformation—less dramatic than war or fire



Japan's obsession with all things *kawaii* (which can mean "cute," "cuddly," or "lovable") is on display at Ueno Park as owners line up their pets for a portrait shoot. The kawaii aesthetic of cute culture has been one of Japan's most successful exports, driving pop culture trends in fashion, technology, video games, and cartoons.



but equally profound. Cities tend toward disorder, and in a way Koike's job is to remember how chaos so recently consumed Tokyo. Then she is compelled to spend her days keeping it at bay.

I asked how she thought the city had changed over her lifetime. It was a standard journalist's question, one she herself had probably asked many times during her earlier career. The governor laughed.

"I know it has changed, but sometimes it feels as if it hasn't," she said. "When you are part of the story, sometimes it's hard to see." ▯

Author **Neil Shea** is a frequent contributor who lived in Sapporo, Japan. He is currently creating a podcast that investigates unsolved lynchings on the Arkansas Delta. Photographer **David Guttenfelder** lived in Tokyo for more than a decade; this is his 12th story for *National Geographic*.





THE FOUR-HOUR COMMUTE

HE WORKS IN SAN FRANCISCO BUT LIVES 120 MILES AWAY. MEET ANDY ROSS, SUPERCOMMUTER. **PHOTOGRAPHS BY CAROLYN DRAKE**



4:00 P.M. SAN FRANCISCO FINANCIAL DISTRICT



4:10 P.M. BOARDING AMTRAK THRUWAY BUS 6640



4:20 P.M. DEPARTING AMTRAK THRUWAY BUS



4:50 P.M. EMERYVILLE TRAIN STATION



6:46 P.M. EN ROUTE TO AUBURN COMMUTER BUS



6:50 P.M. BOARDING AMTRAK THRUWAY BUS 3640



7:50 P.M. WALKING TO PARKING LOT IN AUBURN



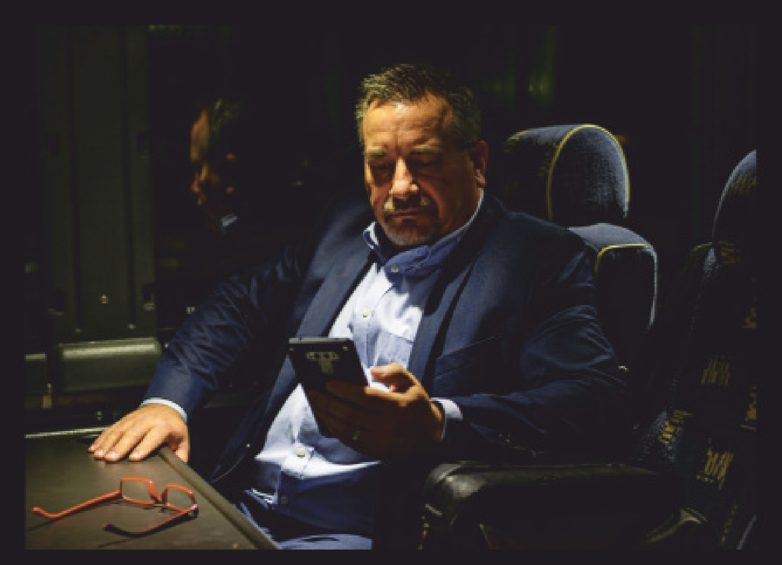
7:55 P.M. DRIVING HOME



4:15 P.M. ON BOARD AMTRAK THRUWAY BUS



5:00 P.M. ON BOARD AMTRAK TRAIN 540



7:00 P.M. ON BOARD AMTRAK THRUWAY BUS



8:05 P.M. ARRIVES HOME IN AUBURN

A COMMUTE GONE 'CRAZY'

Four days a week Andy Ross travels—by car, train, and bus—120 miles from his home in Auburn, California, to his job at a bank in San Francisco. His eight-hour round-trip typically begins at 6 a.m. He'll be at his desk by 10, having begun work earlier on his laptop. He leaves the office by 4 p.m. and arrives home about 8.

Ross became a "supercommuter" eight years ago, after he left a tech business and took the bank job. He joined nearly 105,000 people who spend at least 90 minutes getting to jobs in the Bay Area. Ross and his wife kept their four-bedroom home in Auburn rather than move to San Francisco, where the median price is $1.4 million—more than three times that in Auburn. "I love working at my job. As a result, I'm now doing this crazy commute," he says. "There are a lot more of us long-haul commuters" than a decade ago.

ON THE ROAD AGAIN ... AND AGAIN

U.S. average **26.4 minutes**

METROPOLITAN STATISTICAL AREA*	AVERAGE TRAVEL TIME TO WORK IN MINUTES, 2013-17
New York	36.3
Washington	34.6
San Francisco	32.8
Riverside, CA	32.1
Chicago	31.6
Atlanta	31.4
Boston	31.0
Baltimore	30.8
Seattle	30.1
Los Angeles	30.0

*With more than two million people
SOURCE: U.S. CENSUS BUREAU





SHANGHAI, CHINA

Near the center of this city of 24 million, China's largest, the Yanan expressway crosses under the North-South expressway. The country has gained half a billion city dwellers since 1990—and nearly 190 million cars. "It's truly almost incomprehensible what happened in China," says American urban designer Peter Calthorpe, who has worked there extensively. With nearly 300 million more people expected in cities by 2030, Chinese planners say they're changing course, prioritizing walkable streets and public transit over cars.

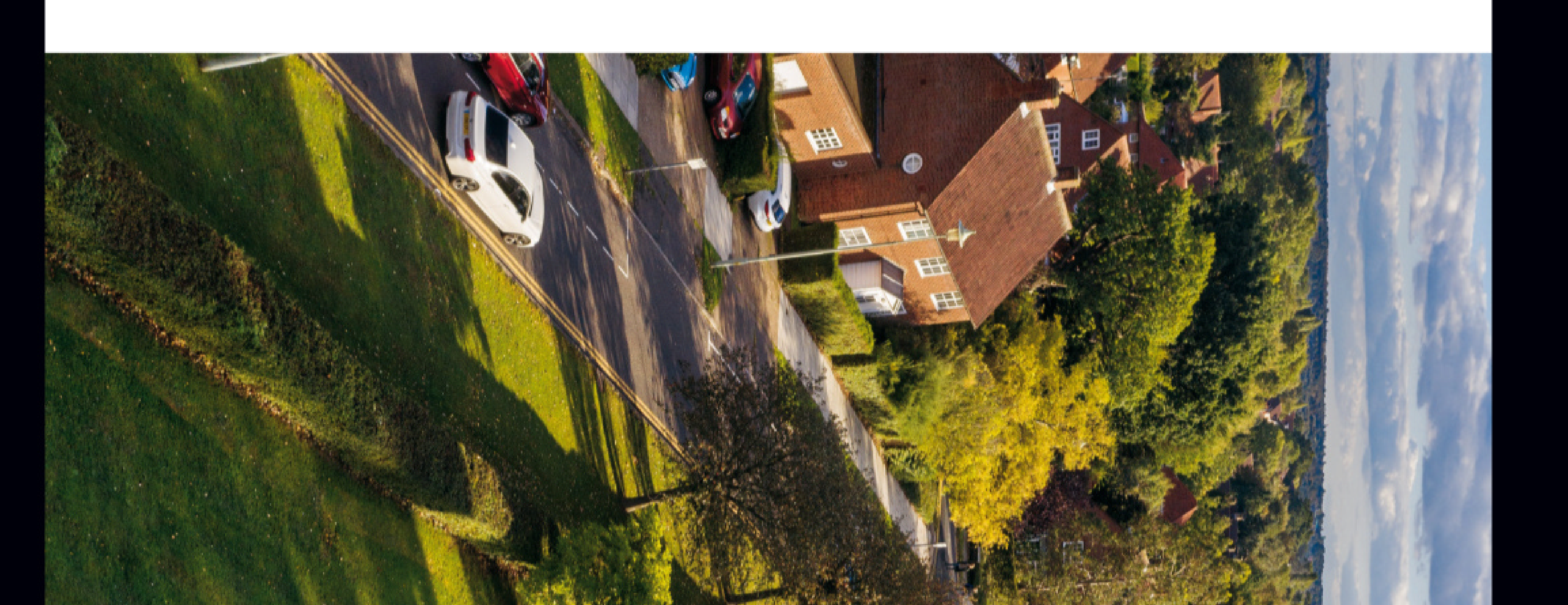
RETHINKING CITIES

BY
ROBERT KUNZIG

PHOTOGRAPHS BY
ANDREW MOORE

PUTTING PEOPLE FIRST

TO MAKE THE MOST OF URBAN LIFE, WE'LL HAVE TO CURB OUR DEVOTION TO CARS.





WELWYN GARDEN CITY, ENGLAND

A century ago, when British urban planner Ebenezer Howard envisioned two "garden cities" north of London, people were starting to flee overcrowded cities in Europe and America. Some of Howard's ideas still seem forward-looking, such as the way he gave Welwyn residents easy access to both green spaces and the metropolis—London is just a half hour away by train.





BAKU, AZERBAIJAN
This oil-rich capital, the country's largest city, has followed the Dubai model of urban development: trophy buildings first, an overall plan later. The Flame Towers are meant to evoke flares at natural gas seeps; at night, simulated flames dance on their facades, which are covered with LEDs. The skyscrapers house an upscale hotel, luxury apartments, and a mall with a Lamborghini showroom.



THE PURPOSE OF CITIES is to bring people together. In the 20th century, we blew them apart. One day last year, Peter Calthorpe took me on a drive through some of the wreckage. He wanted to show me how he proposes to make cities whole again. ¶ Calthorpe is an architect who in the late 1970s helped design one of the first energy-efficient state office buildings, which still stands in Sacramento, California. But he soon widened his focus. "If you really want to affect environmental outcomes and social outcomes, it's not shaping a single building that matters," he says. "It's shaping a community." ¶ Today he runs a small but globally influential urban design firm, Calthorpe Associates. In his spare, airy office in Berkeley, the charter of the Congress for the New Urbanism hangs framed on the wall, denouncing "the spread of placeless sprawl." Calthorpe helped launch the group in 1993. The struggle is long and ongoing. ¶ We waited until late morning for the traffic to settle a bit, then got into Calthorpe's midnight blue Tesla and set a course for Silicon Valley, south of San Francisco on the far side of the distended metropolis.



ROTTERDAM, NETHERLANDS

In the city's historic district, the new Market Hall aims to inspire with its originality—but also to create "a space where we could celebrate and we could meet each other," says architect Winy Maas. The arched apartment building covers a food market that's open daily, as well as bars and restaurants.



“The problem with urban environments that are auto oriented,” he said, as we wound our way toward the Bay Bridge, “is that if there’s no choice, if the only way to get around is in a car, lo and behold, people are going to use cars too much. Too much for the climate, too much for people’s pocketbooks, too much for the community in terms of congestion, too much for people’s time. I mean, every way you measure it, it has a negative—no walking is a prescription for obesity. Air quality feeds into respiratory illnesses.”

In the 1990s Calthorpe scored a breakthrough: He helped persuade Portland, Oregon, to build a light-rail line instead of another freeway and to cluster housing, offices, and shops around it. “Transit-oriented development” sealed his reputation as an urban visionary; in Beijing, I met an environmental scientist who has taken many Chinese planners to visit Portland. It was less of a new idea, Calthorpe said, than a call “to reinvent the old streetcar suburb, where you had fabulous downtowns and you had walkable suburbs, and they were linked by transit.”

On the bridge, despite leaving late, we hit stop-and-go traffic.

IN CALTHORPE’S UTOPIA, in China or America or elsewhere, cities would stop expanding so voraciously, paving over the nature around them; instead they’d find better ways of letting nature into their cores, where it can touch people. They’d grow in dense clusters and small, walkable blocks

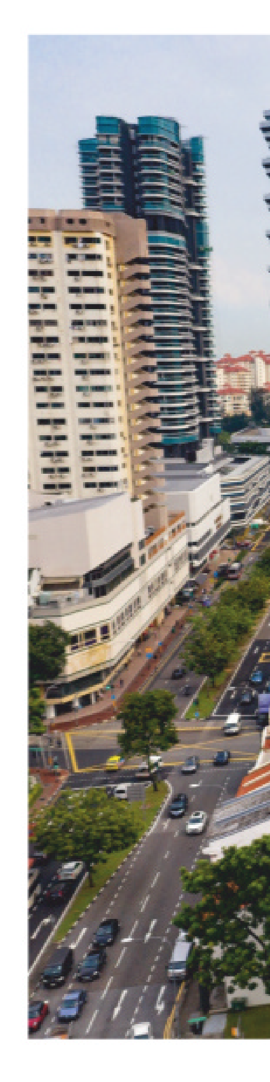




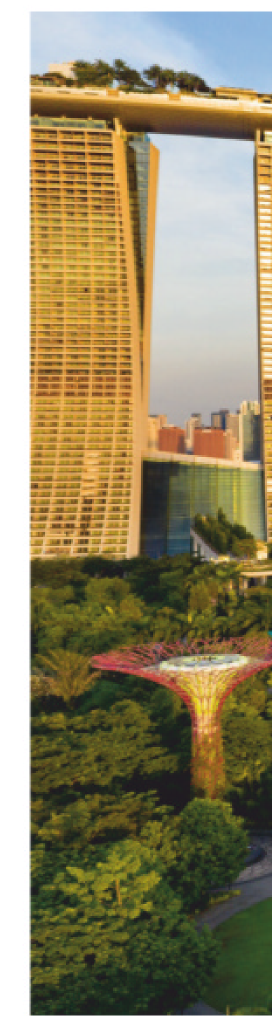
SINGAPORE

Can a high-rise city be a garden city? Singapore subsidizes vertical gardens like these on the 627-foot Oasia Hotel. Designed by a local firm, the building is cooled by 54 species of trees and flowering vines, which attract bugs and birds—and soothe jangled nerves.


A*STAR
GALAXIS











CLOCKWISE FROM TOP LEFT

SINGAPORE

Ebullient tropical flora surges into the courtyard and pours from the terraces of the Lucasfilm building. Singapore, an island city-state with limited space, has to plan carefully to retain links to nature and to its past.

As the city grew rapidly, the government decided to preserve Kampong Glam, a 19th-century Muslim neighborhood around Sultan Mosque, which now has trendy boutiques and restaurants.

Nature climbs the red trellises of the Supertrees located in Gardens by the Bay and crowns the SkyPark that bridges the towers of the Marina Bay Sands Hotel.

The Helix, a bridge designed to look like DNA and lit by LEDs at night, completes a walkway around Marina Bay. Singapore has its share of eye-catching architecture, including the lotus-shaped ArtScience Museum.

around a web of rapid transit. These cities of the future would mix things up again: They'd no longer segregate work from home and shopping, as sprawl does now, forcing people into cars to navigate all three; they'd no longer segregate rich from poor, old from young, and white from black, as sprawl does, especially in the United States. Driving less, paving less, city dwellers would heat the air and the planet around them less. That would slow the climate change that threatens, in this century, to make some cities unlivable.

To do all this, in Calthorpe's view, you don't really need architectural eye candy or Jetsons technology—although a bit of that can help. You need above all to fix the mistakes and misconceptions of the recent past.

South of the San Francisco airport, Calthorpe turned off the Bayshore Freeway. We were headed for Palo Alto, where he grew up in the 1960s, but we'd really come to drive El Camino Real—the road once traveled by Spanish colonists and priests. "It was the old Mission Trail," he said. "And right now, it runs through the heart of Silicon Valley, and it's just low-density crap."

Town after town spooled by, tire shop after U-Haul dealer after cheap motel. El Camino is one of the oldest commercial strips in the western United States, and it's not the ugliest. To Calthorpe, its interest is not as an eyesore but as an opportunity. Not many people live on the road, because it's mostly zoned for commercial use. Yet Silicon Valley is desperately short of housing. Tens of thousands of people commute in cars from throughout Northern California. In Mountain View, home of Google, hundreds actually live in parked cars.

Along the 45-mile stretch of El Camino between San Francisco and San Jose, within half a mile of the road, there are 3,750 commercial parcels occupied by a motley collection of mostly one- or two-story buildings. Calthorpe knows this from the software he and his colleagues have developed, called UrbanFootprint, which draws on a nationwide parcel-by-parcel database and a series of analytical models to game out visions of the future for cities to consider. If El Camino were lined with three- to five-story apartment buildings, Calthorpe explained, with stores and offices on the ground floor, it could hold 250,000 new homes. You could solve the Silicon Valley housing shortage and beautify the place at the same time, while reducing carbon emissions and water consumption and wasted human hours.

In that 45-mile "ribbon of urbanism," children would walk to school again. Their parents would walk to the grocery store and walk or bike to work—or jump on public transit to head up or down the strip. Transit is the key: It would have to be ubiquitous and fast. But it wouldn't be light rail this time, Calthorpe said. That's too expensive now, and a better technology is coming.

It's one many urban planners are terrified of: driverless autonomous vehicles, or AVs. Calthorpe himself thinks that, if AVs are left to individuals or the likes of Uber or Lyft, they will metastasize sprawl. He wants to harness the technology to benefit communities. Down the center of El Camino, on dedicated, tree-lined lanes, he would run autonomous shuttle vans. They'd arrive every few minutes, pass each other at will, and stop rarely, because an app would group passengers by destination. On their protected lanes, as Calthorpe envisions it, the little robots wouldn't run over people—and the technology wouldn't run over our world with its unintended consequences.

Calthorpe is a onetime hippie, but of the techno-friendly *Whole Earth Catalog* kind. In the late 1960s he taught at an alternative high school in the Santa Cruz Mountains, helping the kids build geodesic domes. The valley below wasn't yet nicknamed for Silicon; it was still the Valley of Heart's Delight, covered in fruit orchards. In the foothills, an interstate highway was under construction, to relieve congestion on El Camino and the Bayshore Freeway. "In those days, you couldn't even see the valley," Calthorpe recalled. "It was just a sea of smog. It was just really clear that something was profoundly wrong." Today there's less smog, but the city is still broken, and on his good days, it still seems fixable to him.

WHEN THE CONGRESS for the New Urbanism held its annual meeting last year in Savannah, Georgia, the keynote speaker was Jan Gehl, an urban designer from Copenhagen. An oracular octogenarian, Gehl is revered for his simple insights: Architects and urban designers should build "cities for people" (the title of one of Gehl's books, translated into 39 languages), not cars. They should pay attention to the "life between buildings" (another book title), because it's crucial to our well-being. Gehl has spent decades observing how people behave in public spaces, collecting data on which kinds encourage civic life and which tend to be dispiriting and empty.

"There is great confusion about how to show the city of the future," he said as we sat at an outdoor café on a square shaded by live oaks. From time to time a horse clopped by, pulling a carriage full of tourists. "Every time the architects and visionaries try to paint a picture, they end up with something you definitely would not like to go anywhere near."

He opened his laptop and showed me a Ford Motor Company website called the City of Tomorrow. The image showed a landscape of towers and verdant boulevards with scattered humans and no sign of them interacting.

"Look at how fun it is to walk there," Gehl said dryly. "There are only a few hostages down there among the autonomous cars."

"Towers in the park," as New Urbanists call this kind of design, is a legacy of modernist architecture, whose godfather was Le Corbusier. In 1925 he proposed that much of central Paris north of the Seine be razed and replaced with a grid of 18 identical glass office towers, 650 feet high and a quarter mile apart. Pedestrians would walk on "vast lawns" gazing up at "these translucent prisms that seem to float in the air." Cars would whiz by on elevated expressways. Cars, Le Corbusier thought, had made the streets of Paris, "this sea of lusts and faces," obsolete.

Like most of Le Corbusier's ideas, the Plan Voisin was never built. But his influence was nonetheless global. It's seen in the notorious housing projects of American city centers—some since demolished—and in the corporate office parks that dot the suburban landscape. It lives on too in the dozens of entirely new cities now being planned and built all over the world, especially in Asia. Many of those cities claim to prioritize walking and public transit, says Sarah Moser, a McGill University urban geographer who has studied them, but most in fact don't. Putrajaya, Malaysia's new federal administrative center, is a good example: Half of it is devoted to green space. But as Moser points out, "it takes a lot of walking to get from building to building."

The influence of Le Corbusier is felt especially in the new urban districts that China has slapped up over the past four decades. Calthorpe, who spoke at the Savannah conference, argued that those regiments of identical apartment towers, lined up on quarter-mile-long "superblocks," have something in common with American suburbs, as different as they appear.

"There's one unified problem," he said, "and it's sprawl." The essence of sprawl, he explained, is "a disconnected environment." People living in high-rise towers in a park can be just as disconnected—from their neighbors and from the unwalkable street below—as people living on suburban cul-de-sacs. In China's new towns, narrow streets lined with shops have given way to 10-lane boulevards, crowded with cars rather than bicyclists and pedestrians. "The social and economic fabric is being destroyed," Calthorpe said.

PLANNERS FACE A BIG CHALLENGE: **FIGHTING THE SPRAWL** THAT HAS DISCONNECTED SO MANY COMMUNITIES.

SPRAWL HAPPENED in the United States for reasons that made it seem like a good idea at the time. Millions of soldiers had come home from World War II to overcrowded, run-down cities; their new families needed a place to live. Driving to the suburbs felt liberating and modern. In China, sprawl happened for good reasons too.

In People's Square in Shanghai I toured an exhibit on the city's history with Pan Haixiao, a transportation researcher at Tongji University.



LA PAZ, BOLIVIA

Transit binds a city: When La Paz sent its first cable cars sailing over congested mountain roads in 2014, it linked mostly poor El Alto to downtown, 1,300 feet below. By 2018 nine lines were carrying 250,000 people a day. Cabins arrive every 10 to 12 seconds.


68
8

When he arrived as a student in 1979, traffic was already terrible, he said—not because there were so many cars but because of "the very fine urban fabric," the dense network of narrow streets. In those days, it could take Pan two hours to go downtown from the university, less than four miles away.

Wouldn't it have been quicker to walk? I asked.

"At that time, we didn't have enough food," Pan said. "If you walk, you'll feel very tired. We were always hungry when I was a student."

In the 40 years since Deng Xiaoping decreed the "reform and opening" of China, as its population swelled to 1.4 billion, the country has lifted hundreds of millions of people out of poverty. It has done so essentially by drawing them from the countryside to factory jobs in cities. China's breakneck urbanization is all the more remarkable for having been preceded by Mao Zedong's Cultural Revolution, which sent millions of people the other way, from cities into the country.

"After the Cultural Revolution, the first thing was to make everybody have a home and have enough food," said He Dongquan, a Beijing environmental scientist who is China director for Energy Innovation, a U.S.-based think tank. He grew up in the '70 and '80s in Baotou, Inner Mongolia, an industrial city his parents had helped build. It's now economically distressed—but in its prime it gave young He access to electricity, clean water, and education, for which he considers himself lucky.

As the urbanization drive began, He said, there was a rush to build apartments—and the quickest way was to churn out cookie-cutter towers on superblocks. The financial incentives were powerful, and not just for developers; Chinese city governments can get half or even more of their local revenue from selling land rights. Urban design niceties were overlooked—although following the dictates of feng shui, the towers generally were lined up in orderly, south-facing rows.

Just as with American suburbs, which helped realize millions of American dreams, the results are great, to a degree. The average Chinese family now has 360 square feet of space per person, four times the average of two decades ago. But the spaces between the buildings are uninviting, He said, so people don't use them.

"Everybody feels lonely and nervous," He said. Fearing crime, residents demand fences, turning superblocks into gated communities. The city becomes even less friendly and walkable.



ADDIS ABABA, ETHIOPIA

One of sub-Saharan Africa's first light-rail lines, financed and built largely by China, opened in 2015. Carrying more than 100,000 passengers a day in packed cars, it has begun to transform the capital, allowing workers to reach jobs far from their homes. In Africa's rapidly growing cities, sprawl is an epic challenge.

LAURENCE DUTTON



Meanwhile, in the past 20 years, the number of private cars in China has gone from negligible to nearly 190 million. Beijing now has seven concentric ring roads rippling outward from the Forbidden City. Seventy percent of the transport infrastructure investment in rapidly developing cities is for cars, said Wang Zhigao, director of the low-carbon cities program at the Energy Foundation China, an internationally funded nonprofit.

Public transit is excellent, by American standards, but not good enough to lure enough people out of cars. Part of the problem, in Beijing and other cities, is the sprawling urban form—the legacy of all those years of building hastily. "If we don't make the urban form right, it will be there for hundreds of years," Wang said. "If we continue to provide a driving environment, people will drive, and we'll still be high carbon, even with electric vehicles." China still gets most of its electricity from coal.

A DECADE AGO, WANG AND HE got wind of a new development called Chenggong, in the southwestern city of Kunming. Planned for 1.5 million people, it was a typical Chinese new town: The main street was 90 yards across from curb to curb, 200 from building to building. "We contacted Peter and some other experts then, and they were shocked," Wang recalled. "They said, 'This street is not for human beings.'"

The Energy Foundation flew Calthorpe and an architect from Gehl's firm to Kunming to talk with city officials. "That first lecture, they started buying into the ideas," Wang said. Ultimately the Energy Foundation paid for Calthorpe to redo the plan for Chenggong. "It was already planned, and they already had started the infrastructure," Calthorpe recalls. "They had already laid out the superblocks." Where it was still possible, he divided each one into nine squares, like a tic-tac-toe board, with smaller roads. He put the

buildings closer to the street, with stores on the ground level below offices and apartments.

The project, still under construction, became the first of many that Calthorpe and a young colleague, Zhuojian (Nelson) Peng, have worked on in China. It got the attention of the national housing ministry. And it reinforced a change in mind-set that already was bubbling up from Chinese urban planners—one that then got ratified in a startling way. In 2016 the Communist Party Central Committee and the State Council, the highest organs of the state, issued a decree: From now on Chinese cities were to preserve farmland and their own heritage; have smaller, unfenced blocks and narrower, pedestrian-friendly streets; develop around public transit; and so on. In 2017 the guidelines were translated into a manual for Chinese planners called Emerald Cities. Calthorpe Associates wrote most of it.

"We were a little surprised," said Zou Tao, director of the Tsinghua Tongheng Urban Planning and Design Institute in Beijing, who also contributed to Emerald Cities. "For more than 10 years we've been telling people to do this. We're still getting used to it—and still figuring out how to make it happen in the real world."

Chinese urbanization is at a turning point. The government aims to move nearly 300 million more people—almost equal to the entire U.S. population—into cities by 2030. China faces both a shortage of decent affordable housing and a housing bubble, because many people invest in apartments and keep them off the market, said Wang Hao, a planner who spent 20 years at the Chinese Academy of Urban Planning and Design. "Half the people have moved into the city; the other half can't afford it," she said. The government is trying, all at once, to design cities more humanely and sustainably and deflate the housing bubble without crashing the economy. No one is sure how to do all that, Wang said.

THE KEY TEST MAY COME in Xiongan, a 680-square-mile stretch of swampy land, including a heavily polluted lake, about 65 miles southwest of Beijing. In April 2017 President Xi Jinping announced, again to general surprise, that he wanted to build a new city there. Ultimately it could house five million people and relieve congestion and pollution in Beijing. Last summer, when I visited the site with He and a vanload of planners, all that had been built was a temporary city hall complex. Chinese tourists strolled the treelined streets. An autonomous shuttle bus circulated experimentally and emptily.

TO EASE BEIJING'S CONGESTION, CHINA IS PLANNING
A GREEN, LOW-RISE CITY
THAT COULD BE A MODEL FOR THINGS TO COME.

Xi has declared Xiongan a project for the millennium. A video in the visitors center shows a low-rise, small-block, and extremely green city. It isn't supposed to be completed until after 2035—an eternity by Chinese standards—but the master plan approved in December suggests it will be consistent with the Emerald Cities rule book. Calthorpe hopes to design part of it.

"We're trying to solve all Chinese city problems," said a landscape architect I met, a woman who preferred not to be identified. "We're not sure we're going to. This place will be an experiment."

The next morning, He took me to see a more spontaneous experiment: a trendy arts district called 798, which lies in northeastern Beijing between the fourth and fifth rings. We waited until midmorning for the subway crowds to thin out—during the morning rush, the queues at some stations stretch all the way outside,

because everyone is leaving one district to work in another. The nearest station to 798 was a few superblocks and about a mile away. Fortunately, dockless shared bikes have lately invaded the capital. We rented a couple and pedaled off.

It was a warm late-summer day, with a blue "meeting sky"—African heads of state were in town, He said, so the government had shut down smoke-spewing factories outside Beijing. The 798 district occupies the site of old factories that used to be outside the city too, before the city engulfed them. After the government closed the complex in the 1990s, artists began occupying the low brick buildings. Gradually a neighborhood of galleries, bars, and shops emerged. The blocks are small because they were laid out for a factory compound.

"This is very close to Portland," He said, as we strolled the narrow streets. "We always take Portland as a good example."

In an alley under a large, idle smokestack, we sipped cappuccinos, discussing the dramatic ideological change in Chinese urban planning. Undoing the effects of 30 years of superblock construction, He said, won't be easy. "Given the scale and the economic challenges, it will take 20 to 30 years. You see points, small pieces here and there. We hope that over time, all the urban landscape will change."

IN THE U.S. LANDSCAPE TOO, islands of hope are emerging in the sea of sprawl.

Ellen Dunham-Jones, an architect and urban designer at Georgia Tech in Atlanta, one of the most sprawling cities on Earth, keeps a database of them. In 2009, when she and June Williamson of the City College of New York cowrote their book *Retrofitting Suburbia,* they reviewed around 80 cases of suburban spaces being transformed, mostly into something urban—that is, denser and more walkable. Today the number of projects in the database has grown to 1,500. Across the country, Dunham-Jones told me, developers are adding buildings mixing residential and retail to some 170 office parks. As online shopping kills hundreds of malls, she said, around 90 are in the process of "becoming the downtowns their suburbs never had."

Market forces are driving the transition. The nuclear family for whom suburban subdivisions were envisioned is no longer the statistical norm; only a little over a quarter of all U.S. households consist of people with children. Young people are looking for an urban lifestyle, and so are many of the parents they left behind in the suburbs. In the little towns around Atlanta, as elsewhere in the U.S., Dunham-Jones said, "main streets were mostly killed off in the 1970s. Now that the malls are dying, those main streets are coming back."

In Duluth, Georgia, 25 miles northeast of Atlanta in Gwinnett County, I visited one. Gwinnett was farm country until sprawl hit like a tsunami, Chris McGahee, Duluth's economic development director, told me. From 1970 to 2008, the county's population ballooned from 72,000 to 770,000, Duluth's from 1,800 to 25,000. "When you leave to go to college, you come back and can't find anything you remember," McGahee said. "Except in downtown Duluth, there's a little string of eight buildings that are more than a hundred years old. For some reason, they survive."

McGahee started work in October 2008, at the height of the financial crisis. Out of the pain grew opportunity. "What the recession did for us is make land affordable," he said. Over the next few years the town managed to buy 35 acres around those eight buildings along the railroad tracks. The buildings were nothing special, just little brick relics from the late 19th century. But they had charm and emotional weight.

They've now become the nucleus of a restaurant district with a music venue that offers experiences people can't get online. Around that Main Street, the town is working to have 2,500 units of housing within a 10-minute walk. Townhomes are selling out before they're finished, McGahee said. He lives in one and walks to work at the monumental city hall, which faces a large green.

The most ambitious revitalization project in the Atlanta area is the BeltLine: an effort to breathe new life into a 22-mile loop of abandoned railway lines around the city center. Five segments of the loop, about a third of the total, are now a paved trail for walking and jogging, biking and skating.

"The economic story is a wild success," said Ryan Gravel, who first envisioned the BeltLine in 1999 for his master's in urban planning at Georgia Tech. The $500 million that Atlanta has invested in it has stimulated four billion dollars in development, Gravel said, mostly on the city's east side. Where the Eastside Trail crosses Ponce de Leon Avenue, for example, a giant old Sears, Roebuck warehouse has become the Ponce City Market, a food hall, mall, and office complex. A

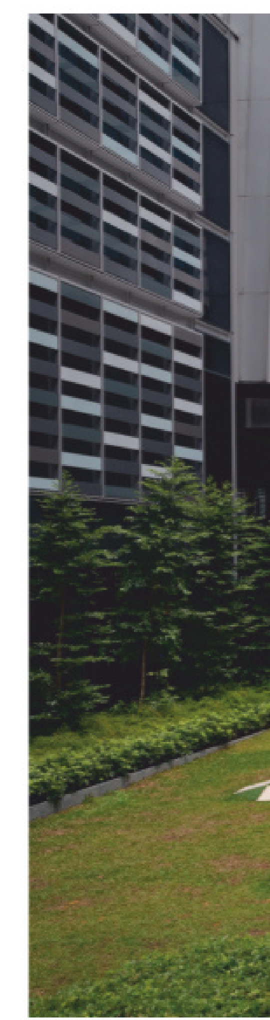


SHANGHAI, CHINA
An elevated walkway allows pedestrians to survive the Mingzhu Roundabout in Pudong and to navigate among the widely spaced office buildings and malls. Roughly a quarter million Chinese die on the roads each year; more than half are pedestrians or cyclists.


陆家嘴环路
陆家嘴西路











CLOCKWISE, FROM TOP LEFT

SHANGHAI

All transit modes intersect at the Wenshui metro stop in northern Shanghai, where the cyclists who once dominated Chinese streets are protected by a dedicated lane.

If you're middle-aged in Shanghai, you remember when the Pudong skyline, seen from the old town, didn't exist. China's incredible building boom is a source of pride—and its legacy of hasty planning is a challenge for the future.

SINGAPORE

Will the cities we build be built for us? Will they be places we flee if we can or places that draw us together? In one of Singapore's newest pocket parks, a family explores a playground in front of a shaded café.

How will we get around cities in the future? One promising possibility is driverless minibuses, which are getting a trial at Gardens by the Bay.

Ford factory that once made Model T's is now loft apartments.

But Gravel's idea was that the BeltLine could bind the fragmented city more powerfully: It was meant to be a streetcar line as well, one that would spur economic development and affordable housing in the places that needed it most—the African-American neighborhoods in the south and west of the city. MARTA, the Atlanta transit authority, has built one small streetcar line and has a $2.7 billion expansion plan. But it has no plans to build the whole 22-mile loop anytime soon. Gravel worries that "the promise won't ever be delivered."

He grew up in Chamblee, a suburb to the northeast, "going to the mall, stuck in traffic on I-285," he said. "Practically every year they added another lane." Then in college he spent a year in Paris. He discovered a functioning subway and the joy of wandering the streets aimlessly. "I learned how to walk in Paris," he said. He came back to Atlanta to be part of changing it.

From the Ponce City Market, we walked south to an old telephone factory, where Gravel plans to open a café and forum to bring people together to talk about the Atlanta they want. Joggers and cyclists and pedestrians streamed by us on the trail. The rail line had always been a physical barrier that separated neighborhoods; now it's a place that connects people.

"That's kind of beautiful," Gravel said.

A CENTURY AGO, as the Ford plant on Ponce de Leon was starting to churn out Model T's, Atlanta was shooting outward along streetcar lines. Many major cities in the U.S. were doing the same, stretching tentacles of rail into the countryside and building villages around the stations. Until after World War II, Los Angeles had the world's most extensive urban rail network, more than a thousand miles of track.

"That is what creates the urban form," said Joe DiStefano, a longtime colleague of Calthorpe's who runs the UrbanFootprint business. "Berkeley is a walkable place because the urban form was generated by the investment in a streetcar system." Even in spread-out Los Angeles, most places were within walking distance of a transit stop, until the city and the country shifted, DiStefano said, "until the automobile made it possible for us to travel broader distances on our own—the automobile, and trillions of dollars of investment in the infrastructure to move it."

Los Angeles became the paragon of car culture. But these days it's trying to move out of that trap—back to the future. Since 2008, Los Angeles County voters have twice approved, by two-thirds majorities, half-cent hikes in the sales tax to pay for an extensive transit expansion—in part, no doubt, because they hope it will get other people off the freeway. "We have soul-crushing congestion," said Therese McMillan, chief planning officer for Metro, the transit authority. The Expo light-rail line to Santa Monica was completed in 2016; the Purple subway line is being extended nine miles, from downtown to near UCLA; and a light-rail line is planned to the southeast—along an old streetcar right-of-way.

Transit alone can't fix Los Angeles; ridership actually fell last year. "Driving's too cheap, housing's too expensive," said Michael Manville, an urban planner at UCLA. People have to pay to ride transit, but not to drive the freeway or to

ACROSS THE U.S., RENEWED DESIRE FOR
AN URBAN LIFESTYLE
IS SPRINKLING SUBURBIA WITH NEW 'DOWNTOWNS.'

park in most places. Meanwhile, an affordable-housing crisis brought on by gentrification and citizen resistance to multifamily housing pushes low-income people, the ones most likely to ride public transit, to the fringes of the metropolis, where public transit is sparse.

Change is happening: In Santa Monica I met one architect, Johannes Van Tilburg, who has designed 10,000 units of housing near transit lines in the past 15 years. But can the whole fabric of a sprawling city be changed?

"I think the answer is absolutely yes," DiStefano said. It took us only 50 years to blow up a walkable urban form that had endured millennia, he said; we could undo that in another 50. DiStefano worked with Calthorpe on the El Camino thought experiment. "That corridor is Anywhere, U.S.A.," he said. The same opportunity exists on strips around the country—the same opportunity to create walkable, connected cities to house a growing population, without cutting another tree or paving another mile.

Before Anywhere, U.S.A., is reimagined, however, it's likely to be hit by the next explosive new technology. Self-driving cars should ultimately be safer than human-driven ones. Bombing along bumper to bumper in 60-mile-an-hour platoons, they may increase road capacity and reduce the space we devote to parking. But by the same logic, they could also dramatically increase the number of vehicle miles traveled, as robotic Uber and Lyft taxis deadhead around the metropolis 24/7, waiting for fares, and as personal-AV owners leave them spinning in traffic to go shopping. And consider, finally, the new impetus that robotic chauffeurs could inject into urban sprawl. If your car becomes a self-driving office or living room or bedroom, how far would you be willing to commute in it?

How about if your car were a plane? In a hangar south of San Jose, I got a glimpse of a future that may not be far off. The hangar belonged to a company called Kitty Hawk, and it contained four little aircraft with cheerful yellow fuselages. Each wing had six electric propellers pointed upward. Cora, as the plane is called, takes off like a helicopter and runs on battery power. It has two seats, and neither is for a pilot—Cora flies itself. A pilot on the ground monitors its progress, taking control remotely if necessary.

Former Virgin America CEO Fred Reid, who oversaw Cora until early this year, explained the rationale for self-flying planes. He began by showing me a video of that soul-crushing traffic in Los Angeles. "There's no doubt in any thinking man's or woman's brain that this is not only going to happen, it has to happen," he said. Kitty Hawk has a bunch of competitors.

The initial market for Cora would be as an air taxi, Reid said. You'd arrive at LAX, say, and a Cora would whisk you a thousand feet above the traffic, flying a predetermined route. It would be relatively cheap, he said, closer to an Uber Black in price than to a helicopter. Being electric, it would be quiet and relatively green. Also, Reid added, "we try to make our planes pretty." He pictures thousands in the skies above L.A.

I'd take one in a heartbeat, I realized.

But what will it be like, I asked Reid, to have thousands of these zipping around the skyline? You're inventing a new technology that has just as much revolutionary potential as automobiles. What kind of world will it make?

"We'll figure it out," Reid said.

MAYBE WE WILL. But it might be wise to do some of the figuring first. We didn't have to go completely nuts about cars, allowing them to become the tail that wagged the urban dog. We didn't have to rip up all the streetcar lines. We didn't have to forget that cities are for people—and we don't need to do it again.

When Gehl started his career in 1960, Copenhagen was choked with cars too. Gehl began as an architect in the modernist tradition, designing the kinds of buildings that he now dismisses as "perfume bottles"—sculptural compositions rather than humanistic ones. But he changed course, and so did his city. Copenhagen has committed to becoming the world's best city for pedestrians and cyclists. It's working. Two-fifths of all commutes now are by bike.

The point is not that bikes are the answer; it's that we can be thoughtful about the shape of our cities. "Waking up every morning and knowing that the city is a little bit better than it was yesterday—that's very nice when you have children," Gehl said. "Think about that...Your children have a better place to live, and your grandchildren have a better place to grow up than you could when you were young. I think that's what it should be like." ▯

Senior editor **Robert Kunzig** focuses on environmental issues. Photographer **Andrew Moore** is known for his large-format documentary photography. This is his first feature for the magazine.

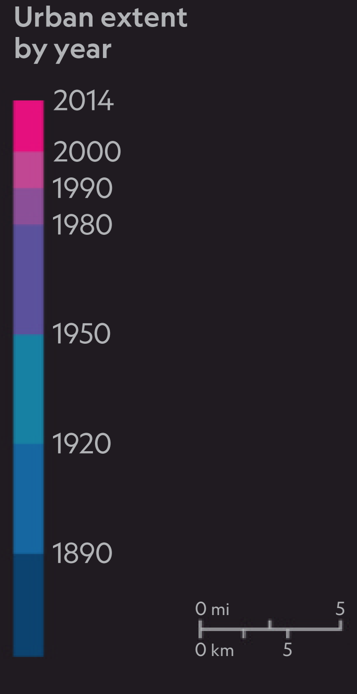
By the early 2000s, the cities of Simi Valley, Thousand Oaks, and Santa Clarita had grown to meet L.A.'s sprawl. They're counted as part of the greater metropolitan area, although residents might disagree.

Santa Clarita
SAN GABRIEL MTS.
San Fernando
Simi Valley
Canoga Park
Thousand Oaks
Van Nuys
Burbank
Calabasas
Hollywood Hills
Glendale
Pasadena
SANTA MONICA MTS.
Beverly Hills
El Monte
Downtown
Santa Monica
Huntington Park
Inglewood
Whittier
Hawthorne
Compton
Redondo Beach
Buena Park
Torrance
Palos Verdes Estates
Long Beach
Garden Grove
San Pedro
Huntington Beach

Downtown Los Angeles was the city's first settled area, with only 6,000 residents in 1870. The arrival of the transcontinental railroad in 1876 brought many more people.

PACIFIC OCEAN

LOS ANGELES is "19 suburbs in search of a metropolis"— a phrase attributed to 20th-century writer Aldous Huxley. To track how metropolitan regions such as the Greater Los Angeles area have developed, Shlomo Angel, a professor of city planning, and his colleagues at New York University used historical maps and satellite imagery to create the Atlas of Urban Expansion, an online mapping project. The atlas defines city parameters as the Romans did with their term *extrema tectorum,* including the entire built area beyond a city's jurisdictional boundaries and into surrounding municipalities. Rail, roads, and real estate play a role in the physical shape of cities, says Angel. So does geography. Los Angeles is constrained by ocean and mountains. Cities without such limitations, such as London, tend to grow more uniformly into a circle.



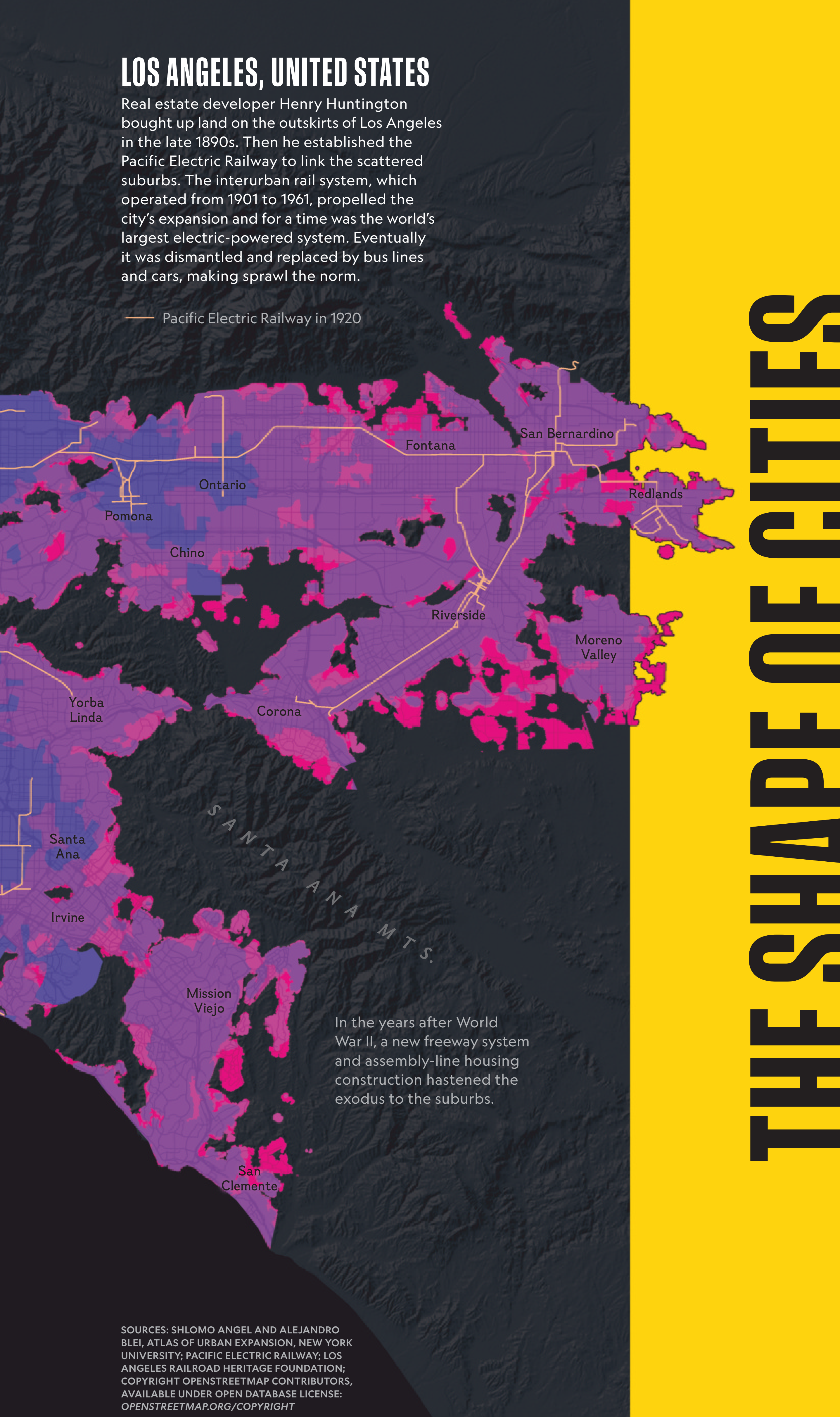
THE SHAPE OF CITIES

A TALE OF FIVE CITIES AND HOW THEY GREW

BY CLARE TRAINOR, JASON TREAT, AND KELSEY NOWAKOWSKI

LOS ANGELES, UNITED STATES

Real estate developer Henry Huntington bought up land on the outskirts of Los Angeles in the late 1890s. Then he established the Pacific Electric Railway to link the scattered suburbs. The interurban rail system, which operated from 1901 to 1961, propelled the city's expansion and for a time was the world's largest electric-powered system. Eventually it was dismantled and replaced by bus lines and cars, making sprawl the norm.



In the years after World War II, a new freeway system and assembly-line housing construction hastened the exodus to the suburbs.

SOURCES: SHLOMO ANGEL AND ALEJANDRO BLEI, ATLAS OF URBAN EXPANSION, NEW YORK UNIVERSITY; PACIFIC ELECTRIC RAILWAY; LOS ANGELES RAILROAD HERITAGE FOUNDATION; COPYRIGHT OPENSTREETMAP CONTRIBUTORS, AVAILABLE UNDER OPEN DATABASE LICENSE: *OPENSTREETMAP.ORG/COPYRIGHT*

LONDON, UNITED KINGDOM

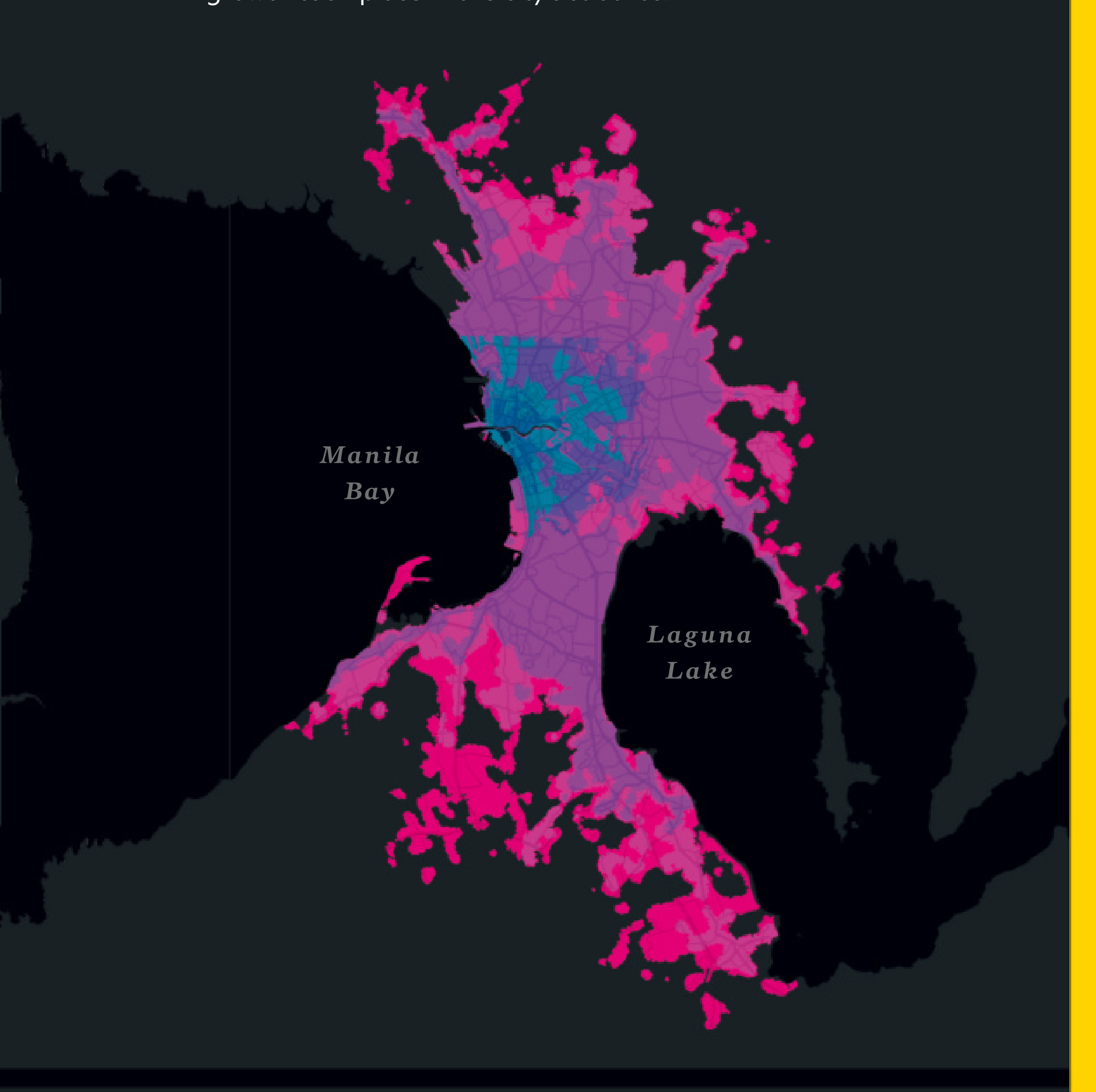
With the opening of the London Underground in 1863, the city spread outward. The Cheap Trains Act of 1883 allowed working-class people to move from grim tenement blocks to railway suburbs. London added the bulk of its population between 1800 and 1900, growing from 1.1 million people to 6.5 million.

SHANGHAI, CHINA

What had been a relatively compact industrial city of 12 million people in 1982 has now doubled. The city rapidly spread in the 1980s when the government began opening the country to foreign investment. Shanghai's physical footprint has swelled so quickly that population density has declined since the 1990s.

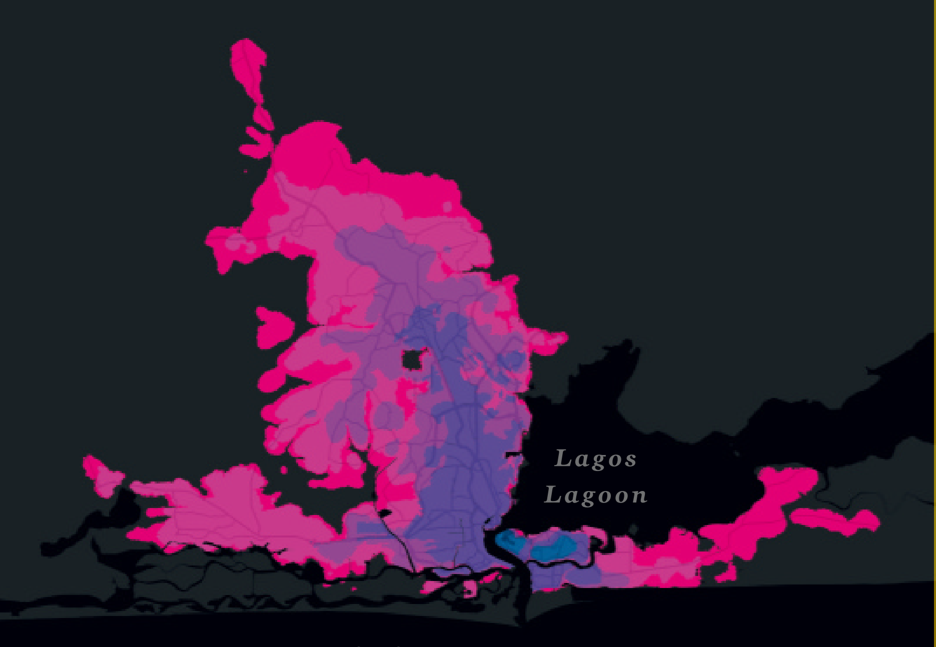
MANILA, PHILIPPINES

Situated between the sea and a lake, the city expanded on a north-south axis. Since 1950, nearly 50 percent of the Philippines' urban population growth has been in the Manila area. That intensified from 1980 to 2000, when almost all the urban growth took place in the city's suburbs.



LAGOS, NIGERIA

After Nigeria gained independence from the British Empire in 1960, oil production soared, bringing people and money to the capital. Now coastal wetlands are being drained to meet development demands from foreign investors and rural Nigerians migrating to the city.

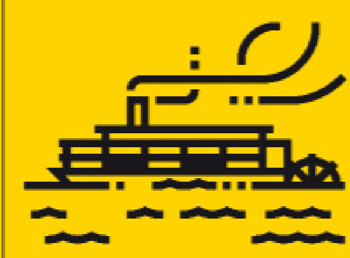


INNOVATIONS THAT SHAPED CITIES



RESISTING ATTACK

Walls long protected cities from invaders. Cannons became a threat—until residents developed thick, sloped walls able to withstand blasts. Once nation-states made the walls unnecessary, cities could spread out.



FACILITATING TRADE

Port cities flourished as global centers of industry. To move cargo inland, rail lines extended out from the cities into the country in all directions. This led to tentacle-shaped development patterns.



MOVING PEOPLE

When the elevator was introduced in the 1850s, cities grew denser and taller. Cities were able to stretch farther into the suburbs when cars and buses filled in the transportation gaps left by rail lines.


KEEP
CALM
AND
SCHEDULE
ON
OLA
VODKA
KICK
NOMI
Softcare





LEFT
In Uganda's Bidibidi refugee camp, markets become lively meeting places after dark. Kennedy Lemmy, a 22-year-old from South Sudan, sells items like bread, diapers, and soda thanks to a national policy that allows refugees to work.

ABOVE
Driven out of South Sudan by war, refugees try to make the best of what little they have in the camp. From mud cell phones to cardboard toy trucks, children fashion their own ingenious entertainment out of available materials.

THE GOAL: TO BUILD A LIVABLE CITY OUT OF A REFUGEE CAMP

A CITY RISES

BY
NINA STROCHLIC

PHOTOGRAPHS BY
NORA LOREK

CAN UGANDA TURN AFRICA'S LARGEST REFUGEE SETTLEMENT INTO AN URBAN HUB?



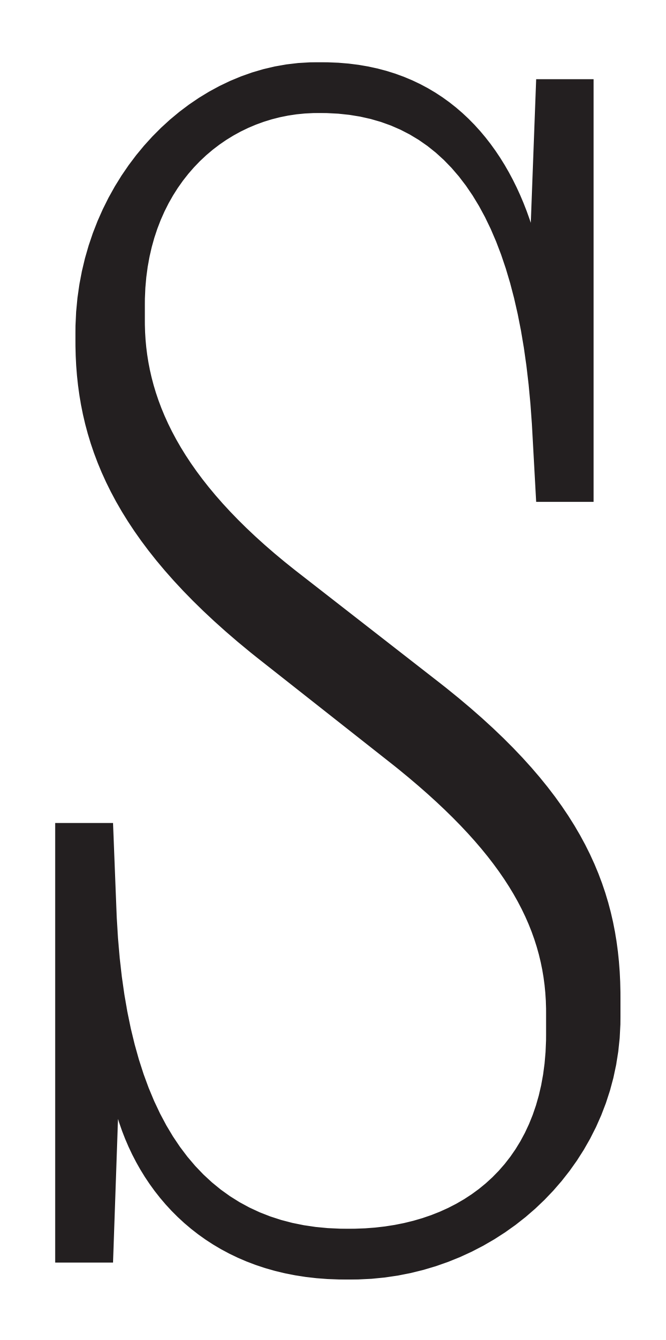


With women taking care of children and household chores, television halls pack in a largely male clientele, charging 15 cents to watch movies or soccer games. The owners of such venues see a day when the camp will become self-sufficient.



Most of Bidibidi's residents are children, who attend school and congregate on playgrounds like this one. As Bidibidi transforms into a permanent settlement, nearly all of its schools have been rebuilt with brick.


EastAfrican



STANDING IN A SLIVER OF SHADE cast by a solar streetlamp, David Kwaje plugs statistics into his smartphone. ¶ Hidden from the harsh midday sun, he can see downhill to a row of white warehouses where residents collect food rations and beyond to two large tanks that supply water to roadside taps, yellow jerry cans radiating in all directions. ¶ All week Kwaje has been walking along dirt roads, plotting every business, church, school, clinic, water tap, and light source on a digital map. At each stop he marks the location and asks detailed questions: Does your school have running water? What hours is this store open? How many doctors does the clinic have? By the time he and a half dozen other mappers finish, they'll have created an open-source guide to an area that's more than twice the size of Paris. ¶ This is Bidibidi. With a quarter million people living in its many villages in northern Uganda, it's the second largest refugee settlement in the world, after the Rohingya camp in Bangladesh. ¶ Kwaje, who is 26, arrived two years ago. Around him a forest was razed and 250 miles of roads

In South Sudan, Rose Asha Sillah, shown with her daughter, helped start a timber company that grew into a 35-employee operation. In Bidibidi, she launched a women's center that teaches skills such as embroidery and farming to about 400 women. Without financial institutions, even innovative entrepreneurs struggle, but Sillah thinks it's worth it. "Will we spend 10 years crying for South Sudan?" she asks. "We need to look forward."

The International Women's Media Foundation supported Nina Strochlic's reporting from Uganda.



were carved through head-high grass and over streams to make room for a flood of South Sudanese fleeing war just a few hours north. He and his family built a cluster of mud-brick homes on a plot of land. He got married and had a son. Now, for the nonprofit Humanitarian OpenStreetMap Team, he's documenting Bidibidi's transformation from temporary camp to permanent city.

With a single earbud in, Kwaje crosses the road to one of Bidibidi's five secondary schools. Thick tree limbs are enclosed by plastic tarps with window cutouts flapping in the wind. Kwaje is string bean tall and talkative, with a restless energy. But the day has been long, and as he walks across a rock-strewn courtyard, he's overtaken by a heat-induced apathy—until he catches sight of a young man in a gray dress shirt. "This was my teacher in South Sudan!"

He jogs over for a hug then folds his gangly frame into a chair, pulls out his phone, and drills Soko Khamis, his former high school teacher and now the Bidibidi school's academic director, with a series of questions, each punctuated by a finger snap: When did this school open? (February 2017.) Is this structure temporary? (Yes.) What are the challenges? (The bathrooms are falling apart. The students are hungry. Books are in short supply.)

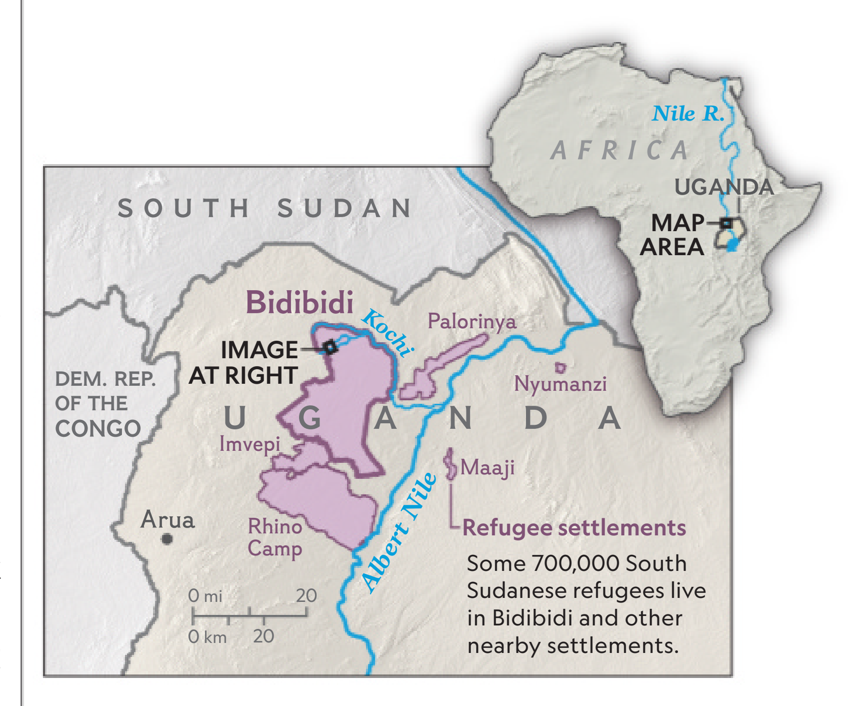
"When are you going back to our school?" he asks.

"Ah," Khamis sighs. "There is still war there."

A GREAT EXPERIMENT is under way in Uganda. An industrial skyline of water and cell towers hovers over sturdy mud huts and small farm plots. Schools and health centers are built from brick, slathered in concrete, and fitted with glass windows. Taps run freshwater, and small solar panels power streetlights, as well as radios blasting music from barbershops, televisions airing soccer matches in community halls, and cell phones snaking from charging stations in shops.

In camps around the world, refugees live crammed in tents, makeshift shelters, or metal dwellings. They're restricted by laws that make work and movement outside the camps impossible. Even in well-planned camps such as Azraq in Jordan's desert, the starkness of life without jobs or a sense of belonging sends refugees back to Syria or forces them to try to earn money in dangerous, under-the-table arrangements.

In Uganda, under one of the world's most progressive policies, those who've fled civil war in South Sudan can live, farm, and work freely.



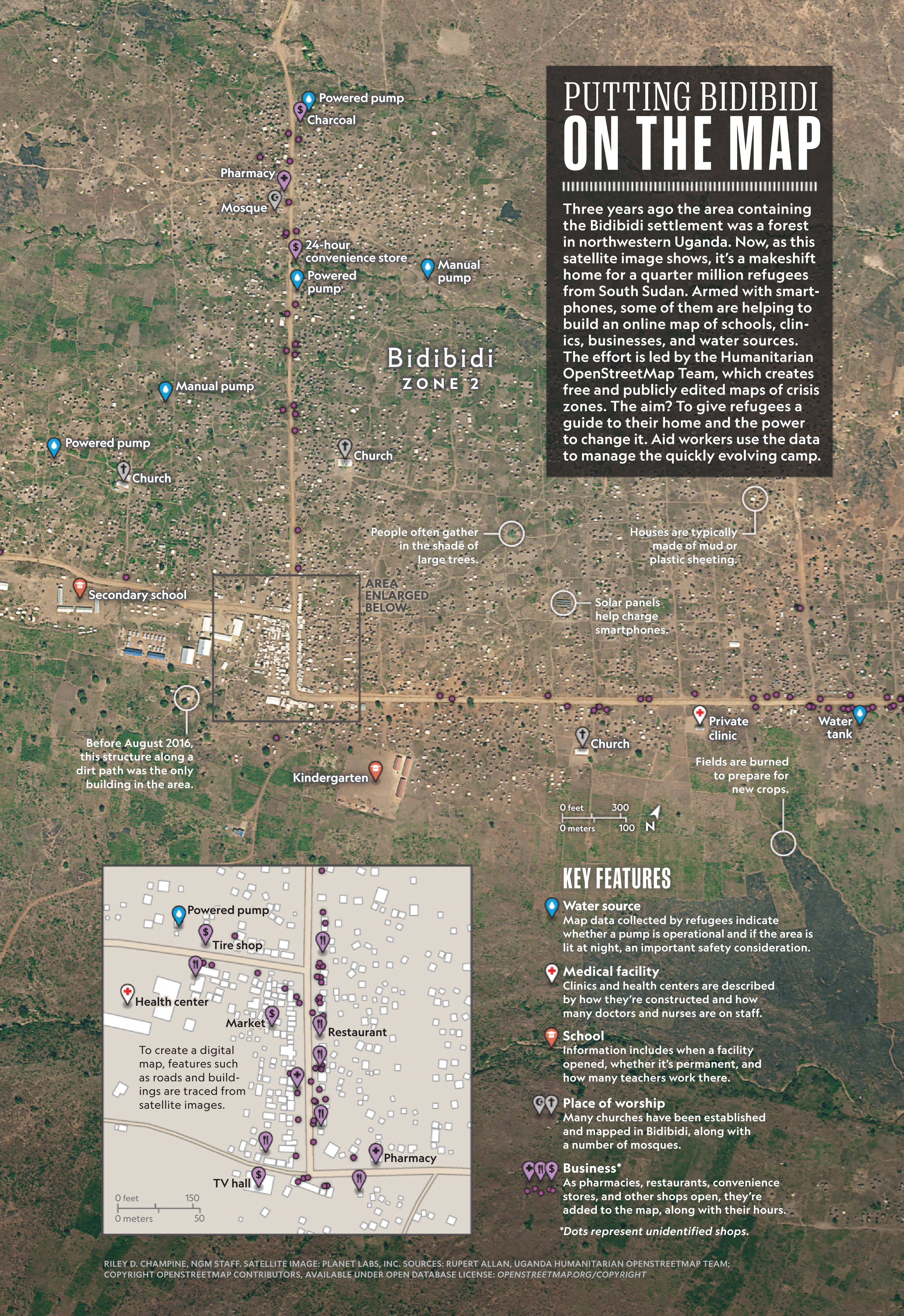
Here, Bidibidi's future is discussed at the highest levels of government and the international community. The goal: To build a livable city out of a refugee camp, one that might endure even if the refugees can return home someday.

Consider that Venice was founded in the fifth century by refugees fleeing war on the mainland, and Palestinian camps founded 50 years ago are indistinguishable from other neighborhoods in the Middle East, and it seems feasible that a refugee crisis could birth a permanent—perhaps even a beautiful—city. Most camps worldwide are still built as temporary way stations. Speed and survival take priority, and aid groups, host countries, and refugees themselves hope they'll return home soon. The reality is different: Refugees stay in exile for an average of 10 years. As the world grapples with record-breaking displacement, maintaining temporary camps is costing hundreds of millions of dollars a year and suspending the lives of millions of people.

In December 2013, two years after South Sudan gained independence from Sudan, conflict between rival government leaders erupted into civil war. A peace deal paused the fighting, but in July 2016 the agreement crumbled. As indiscriminate killing swept the country, tens of thousands of people escaped to Uganda. Bidibidi opened that August, and almost immediately 6,000 people a day began arriving.

A month later, all 193 United Nations member states pledged to integrate refugees more fully into their societies. Thirteen countries, including Uganda, are piloting this strategy. But it's hardly revolutionary in Uganda, where refugees have been allowed to live and work for a decade. In 2017, Uganda launched an effort to encourage development in refugee-hosting areas.

Uganda has transformed the majority of Bidibidi's schools and clinics into permanent



PUTTING BIDIBIDI
ON THE MAP
Three years ago the area containing the Bidibidi settlement was a forest in northwestern Uganda. Now, as this satellite image shows, it's a makeshift home for a quarter million refugees from South Sudan. Armed with smartphones, some of them are helping to build an online map of schools, clinics, businesses, and water sources. The effort is led by the Humanitarian OpenStreetMap Team, which creates free and publicly edited maps of crisis zones. The aim? To give refugees a guide to their home and the power to change it. Aid workers use the data to manage the quickly evolving camp.
Powered pump
Charcoal
Pharmacy
Mosque
24-hour convenience store
Powered pump
Manual pump
Bidibidi
ZONE 2
Manual pump
Powered pump
Church
Church
People often gather in the shade of large trees.
Houses are typically made of mud or plastic sheeting.
Secondary school
AREA ENLARGED BELOW
Solar panels help charge smartphones.
Private clinic
Water tank
Church
Before August 2016, this structure along a dirt path was the only building in the area.
Kindergarten
Fields are burned to prepare for new crops.
0 feet
300
0 meters
100
N
Powered pump
Tire shop
Health center
Market
Restaurant
To create a digital map, features such as roads and buildings are traced from satellite images.
Pharmacy
TV hall
0 feet
150
0 meters
50
KEY FEATURES
Water source
Map data collected by refugees indicate whether a pump is operational and if the area is lit at night, an important safety consideration.
Medical facility
Clinics and health centers are described by how they're constructed and how many doctors and nurses are on staff.
School
Information includes when a facility opened, whether it's permanent, and how many teachers work there.
Place of worship
Many churches have been established and mapped in Bidibidi, along with a number of mosques.
Business*
As pharmacies, restaurants, convenience stores, and other shops open, they're added to the map, along with their hours.
*Dots represent unidentified shops.
RILEY D. CHAMPINE, NGM STAFF. SATELLITE IMAGE: PLANET LABS, INC. SOURCES: RUPERT ALLAN, UGANDA HUMANITARIAN OPENSTREETMAP TEAM; COPYRIGHT OPENSTREETMAP CONTRIBUTORS, AVAILABLE UNDER OPEN DATABASE LICENSE: OPENSTREETMAP.ORG/COPYRIGHT


DARLING
DARLING
spiral
DARLING



Knight Mai (left) and Florence Stima (right), who are South Sudanese, work at a salon in Bidibidi. Each makes less than five dollars a week. Small businesses have filled out market areas, but few private companies have tapped into the labor potential of the camp.

A CITY IS FORMING AROUND THEM, AND LIKE RESIDENTS EVERYWHERE, **THEY WANT TO HAVE THEIR SAY.**





CLOCKWISE FROM TOP LEFT

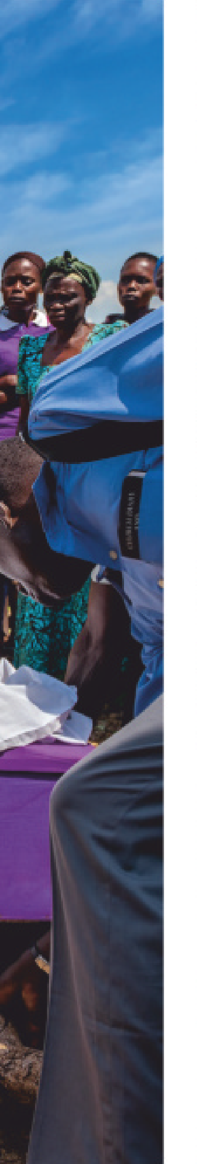
When Twajiji Primary School opened, classes were held in tents. Now, permanent classrooms border a courtyard. "The school system is developing," says Akena Baptist Lotard, the deputy head teacher.

A wedding ceremony in one of Bidibidi's largest churches lasted more than six hours.

Jobs in the camp are scarce, and there's little entertainment. In the markets, men pass the time by playing pool and dominoes.

Lily Ipayi, who died of complications from HIV/AIDS, was buried in Bidibidi's newest cemetery. Her husband hopes to take her body back to South Sudan when peace comes.









As Esther Minella prepares vegetables from her garden, neighbor Ronah Halima holds Minella's grandson. Halima feeds and clothes 11 kids, some of them orphans, by selling meals she cooks to workers who are building a church.

structures and installed a water system. Unlike many refugee camps, which are isolated and gated, Bidibidi merges almost seamlessly into its surroundings. The refugees' homes, surrounded by corn, peanuts, and sesame plants, are nearly identical to those in the Ugandan villages between the camp's five zones. When—or if—the South Sudanese go home, Ugandans will use the new schools, health clinics, and piped water.

"We may not have serious infrastructure like other cities, but I believe that those who saw New York within two years of its formation wouldn't say it was much better than Bidibidi," says Robert Baryamwesiga, the Ugandan official who established the camp and continues to oversee it. "If we are given that time, we can also make a very big city."

IT'S WEDNESDAY AT 4 P.M., and a meeting at the Ministry of Useless Affairs is called to order. Henry Anguyo, in a neat plaid button-down, presides from a plastic chair next to a shack on the side of a long dirt road. Two dozen members sit in chairs and on the ground.

A city is forming around them, and like residents everywhere, they want to have their say. The ministry is a kind of civic club started by frustrated refugees seeking to improve conditions. Many inhabitants feel ignored by the camp bureaucracy and can't afford even basic supplies such as soap and shoes. The ministry has sought to tackle issues like unemployment, broken water taps, and pregnant women being hassled during monthly food-ration distributions. Someday the group hopes to have done enough to change the ministry's name to "Useful."

Anguyo was a teacher in South Sudan, and his patience comes in handy as the complaints pile up. He listens for a while with a serene smile before interjecting: "Now, what are solutions?"

Early on, aid workers saw long-term potential in Bidibidi. Miji Park, who was setting up programs for Mercy Corps, was impressed by how quickly a market popped up near the reception area. "From the very beginning you could see the future," she recalls. "It was clear there'd be huge economic growth."

But in Bidibidi, a medical technician can find himself hawking papaya and passion fruit, while a nurse makes a living selling shards of plastic bottles covered with fabric scraps as earrings. Bidibibi's inhabitants live in subsistence limbo. If the economy doesn't get a jump start, they'll return to South Sudan or leave the camp for another city in search of work.



Long-term stability means shifting the refugee-camp paradigm from humanitarian aid toward private industry. A California-based think tank called Refugee Cities is lobbying refugee-hosting governments to build development zones that could draw foreign investment. "If you create the legal space in which economic activity is allowed and people are given basic legal stability, you can unleash tremendous dynamism that ultimately creates prosperity," founder Michael Castle Miller says. "Not just for people there—but throughout the country."

Blueprints and budgets drafted by various humanitarian organizations show how economic development might come to Bidibidi: Wi-Fi zones, mini-electrical grids, large-scale production facilities. For now, business is small-scale, and private companies are only starting to think about how to tap Bidibidi's idle labor force.

In a tarp-covered workshop, two refugees pound a pulpy biomass mixture into small cakes and lay them out to dry in a greenhouse next door. Every morning jumpsuit-clad workers



HOW TO HELP

For a list of organizations working with refugees in Bidibidi, go to *ngm.com/apr2019*.

A disc jockey plays music from the top of a truck. Festivals, fashion shows, and even a Miss Bidibidi pageant have been held in the settlement. "I still remember when we were beginning, there was not a single road, school, or borehole," says camp overseer Robert Baryamwesiga. He envisions a world-class city emerging from the forest. "I say the sky's the limit."

carry a stack of cakes, 25 cents each, to nearby houses. In small kitchen huts, customers light a special stove and insert the briquette—an eco-friendly solution to the demand for wood to fuel cookstoves. For the rest of the day a large pot of beans or rice simmers on top.

Pamela Komuhendo, a red beanie pulled over her braids, describes the challenges facing Raising Gabdho, the briquette company she cofounded three years ago in Kampala. It grew so quickly that new customers are now accepted only by referral. Bidibidi presents a new hurdle: There's little infrastructure to support new business. Despite this, Raising Gabdho has decided to build a plant and an 11-kilowatt solar mini-grid that could help launch 40 to 50 new businesses.

"There are people planning to settle here," Komuhendo says. "Even if there's peace in South Sudan, they'll stay here if they're making money."

On a busy market street where people come for a haircut, a warm beer, or to catch a soccer match, Patrick Aleko irons church logos and team names onto T-shirts in his solar-powered graphic design shop. He ran a similar business in South Sudan. The pink and blue structure is the sturdiest on the block, and inside he teaches kids design on two computers. When he put up his concrete building, the neighbors chided him: You're wasting money—next year we'll be back in South Sudan. Now they're tearing down their tarps and buying bricks.

As the sky darkens, Aleko moves outside and perches on a wooden stool. "I'll be the last person here," he says, a security light casting a glare over the emptying market. "I'll close my doors and say goodbye to Bidibidi when it's just dogs in the street—when there are no more customers."

What, he wonders, will happen to the camp if South Sudan achieves peace? Will the Ugandan government be able to maintain what's been built, or will millions of dollars of infrastructure rot in the forest? He knows what he thinks the answer should be. "Bidibidi will become a role model," he exclaims. "Let it become a permanent settlement." ▫

Staff writer **Nina Strochlic**'s latest piece for *National Geographic* was about shark conservation, while **Nora Lorek** last photographed women in Bidibidi who make traditional decorated bedsheets.





Lola Cheatham holds daughter Winry while Darrick Alexander holds older daughter Maybel in the Nissan minivan they lived in at a "safe lot" in San Diego's Golden Hill neighborhood. In December 2018 the family found an apartment that they could afford.
JOHN GASTALDO

THE WORKING HOMELESS

THEY CAN'T AFFORD HOUSING NEAR WHERE THEY WORK, SO THEIR CAR IS HOME.

BY CHRIS BORRELLI



Originally from Portland, Oregon, Thomas Lindley, 49, came to San Diego to care for his ailing dad. He sleeps in his car with a 14-year-old pit bull, Kiya, in a safe lot each night. Lindley sold his house in Portland and bought a sailboat, but after it was impounded, he couldn't afford to get it back. He works as a Lyft driver and handyman.
DINA LITOVSKY

It's a day like any other in San Diego, built from blue skies, 74 degrees, palm trees, school buses, traffic congestion, Taco Bell, and Hobby Lobby. The morning light is flat. Yet at the horizon, a haze, an implacable stirring.

Drive away from the Pacific Ocean, into the working-class enclaves and commercial strip mall anywheres, and look closer. There, in that random Nissan *chug-chug-chugging* at the red light, or there, in that minivan by the curb, you see a life's possessions, consolidated and squashed into rounded lumps of shirts, towels, and blankets flooding through the gaps between the headrests.

Now drive about nine miles from the beach to Golden Hill, to a parking lot beneath the Martin Luther King Jr. Freeway at the New Life Assembly of God church. The lot is leased by the nonprofit Dreams for Change. Every night around six, you'll find more cars stuffed with entire lifetimes, parked in the fading afternoon dusk, their occupants looking uniformly beaten down.

For two years Darrick Alexander has lived in the parking lot with his girlfriend, Lola Cheatham, and their three daughters. The lot is part of the Safe Parking Program, one of 35 secure lots in Southern California run by charities and nonprofits and set aside each night for more than 1,500 people who sleep in their cars.

Alexander has just arrived from his job as a manager at a drug treatment and mental health facility, at the end of a 40-minute evening commute. He's calm, soft-spoken, and disarmingly agreeable for a man in his 30s with a family in this situation. The gray leather seats of his 2002 Volkswagen Passat already are reclined for sleeping, the sunscreens ready to slip into place, more for privacy than any California sunrise. His daughters—ages four, six, and 14—will sleep in their mother's van, parked nearby.

Many in the lot have full-time jobs. But they can't afford housing in San Diego, one of the nation's most expensive markets, where the median home value is $633,000 and the average rental is about $2,000 a month.

They need to live relatively close to where they work, so they wind up living in their cars. Without them, they'll never afford housing.

Like many Americans, they're painfully aware of how conjoined the need for a reasonable commute and affordable housing has become. Their lives are a coiled convergence of personal problems, rising rents and stagnating wages, lengthy commutes, and little opportunity for housing in metro areas. It's never one thing.

The safe-parking project began in Santa Barbara more than a decade ago and then spread along the West Coast. Many of the residents are not chronically homeless but have been middle-class—they come from families that lived in the region for generations but then began to struggle after a job loss, a rent hike, a divorce, a medical bill, a foreclosure, an addiction. They come from areas that lack affordable housing, which includes much of California. Gentrification of their neighborhoods left

them unable to both live and work there.

Alexander and others at the lot did the calculations and decided that if they no longer could afford to pay for decent housing and a car to get them to work, then the car had to stay.

Alexander's girls spin in frenzied laps, chasing each other and flying plastic bags behind them like parachutes. The four-year-old, Winry, plows headlong into him: "Daddy, bathroom?"

He walks her into the church; like everyone else here, they get five minutes in the bathroom. When they return, he watches the girl dart off and says softly: "They want somewhere to live. We tell them, 'We are going to get you there.' " Those bags, he says, are for snack night, which tonight means a visit from a local church group that drops off sandwiches, salads, and bread.

When the safe lot closes for the day at six a.m., Alexander heads to work and Cheatham takes the girls to a park. They pay two dollars for showers at a community center. The older girls have been homeschooled at a library. Winry has lived in a safe lot for most of her life. At night the family returns when the lot opens at six and claims the usual parking spaces. Children must be in their cars by nine.

Once the girls and their mother are asleep in the van, Alexander tucks a pillow behind his head, pulls up a thin blanket, and curls into the driver's seat of his car. At night, he says, "I still wake up to every noise."

Thanks to aid from a San Diego housing program, after years of living in the safe lot, Alexander's family would finally find an apartment they could afford.

Ava Blackwell began working as a case manager for the Safe Parking Program five years ago. She says she cried a lot at first. Now she walks me through the New Life lot with solemn, efficient dispassion: That car holds a whole family. No one in this car speaks English, but they all work. The owner of that car paints houses. The owner of the car with bicycles commutes two hours each way.

The next morning, parking lot residents across the city begin to wake. Their cars are Jeeps and Lexuses, VWs and Priuses. A man named John McCarthy removes a tarp from his car's windows, belts his pants, and puts on his work uniform. He drives a bus for disabled people.

A teenager uncurls from the back of his father's hatchback, stretching. A woman walks her dog beside her car. The sun rises, and another nice day in San Diego begins. □

LEAST AFFORDABLE

Single-family homes in California's metro areas are among the nation's least affordable.

METRO AREA	HOUSING AFFORDABILITY INDEX
San Jose, CA	66.1
Anaheim	67.1
San Francisco	69.5
Honolulu	70.1
Los Angeles	73.2
San Diego	77.5
Naples, FL	95.6
Miami	108.3
Riverside, CA	112.3
Boulder, CO	113.6
New York	119.6
Portland, OR	124.0
Seattle	124.0
Denver	125.3
Barnstable Town, MA	125.4
Reno, NV	128.6
Boston	133.8
Sacramento, CA	134.5
Eugene, OR	143.1
Las Vegas	145.8
Cape Coral, FL	149.9
Orlando, FL	150.3
Salem, OR	152.0
Yakima, WA	155.3
Salt Lake City	156.6

A value of 100 means that a family with the median income in 2016 had just enough income to qualify for a mortgage on a median-priced home. (An index of 120.0 means a median-income family has 120% of the necessary income.)

MORE AFFORDABLE ↓

SOURCE: NATIONAL ASSOCIATION OF REALTORS


RECTOR ST
ONE WAY
PATH
FX
RECTOR ST
ONE WAY
MetroCard at all times



ACCORDING TO BOBBY CORRIGAN, A RAT EXPERT, **RATS HAVE LEARNED TO HUNT AND KILL PIGEONS.** “THEY LEAP ON THEIR BACKS LIKE A LEOPARD IN THE SERENGETI,” HE SAYS.

NEW YORK CITY
Adaptable and smart, rats of several species have evolved to thrive in major cities—yet the sight of a rat scurrying across West Broadway can make even the most hardened urbanite jump. Many humans find rats frightening and revolting, even though rats and people have occupied shared living spaces for thousands of years. New York rats are primarily Norway (or brown) rats. Their ancestors lived in the wild in northern China and Mongolia, were established in parts of Europe by 1500, and then followed Europeans across the Atlantic Ocean by the 1750s.

BY
EMMA MARRIS

IN THE CITY'S SHADOW

PHOTOGRAPHS BY
CHARLIE HAMILTON JAMES

LORDS OF THE FILTH

WHEREVER THERE ARE PEOPLE THERE WILL BE RATS, THRIVING ON OUR TRASH.

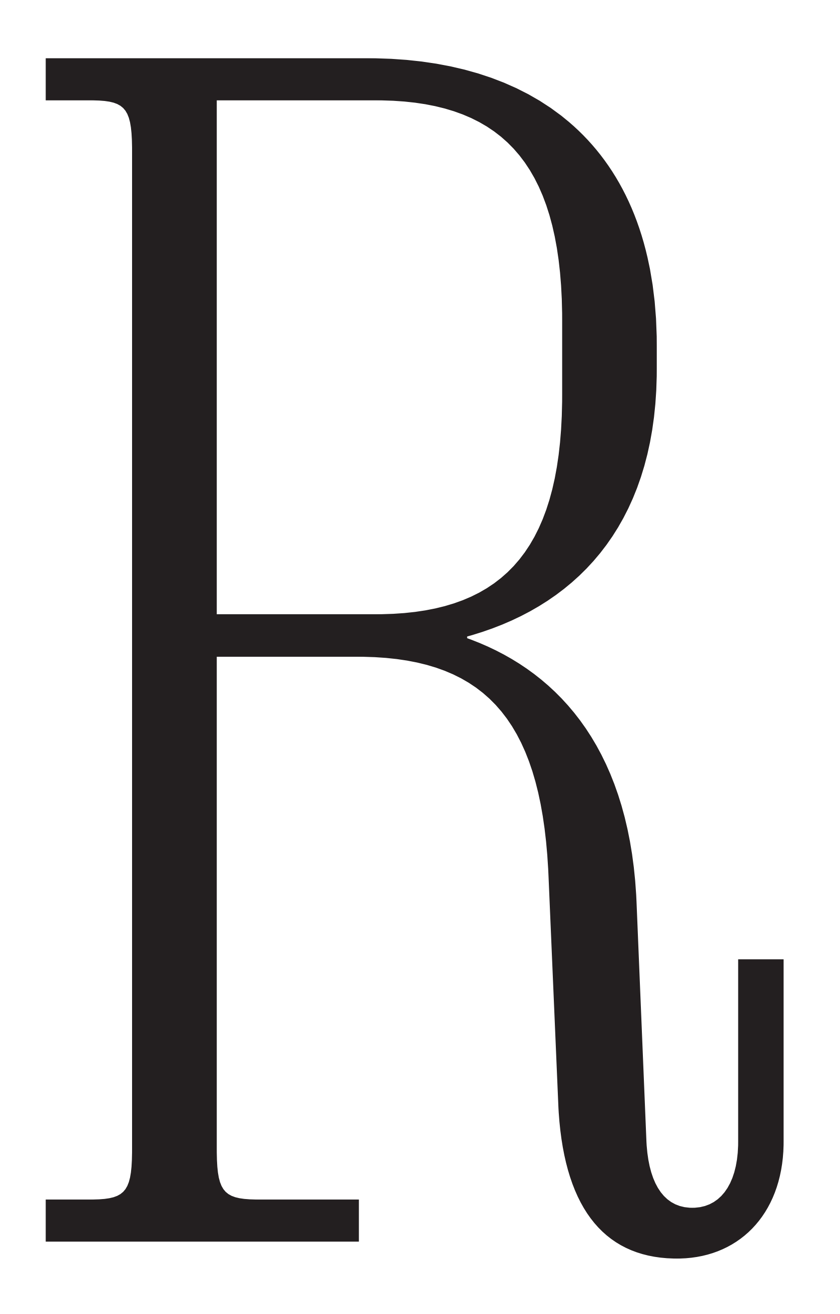




NEW YORK CITY

Rats prepare for a night of foraging in a wastewater drain. Rodentologist Bobby Corrigan estimates that there was as much as a 15 to 20 percent rise in global urban rat populations in the past decade: The more edible trash people toss out, the more rats there will be to eat it.


NEW YORK CITY
DEPARTMENT OF SANITATION
NO HOUSEHOLD TRASH
NO BUSINESS TRASH
$100 FINE



RATS ARE OUR SHADOW SELVES. We live on the surface of the city; they generally live below. We mostly work by day; they mostly work by night. But nearly everywhere that people live, rats live too. ¶ In Seattle, where I grew up, the rats excel at climbing sewer pipes—from the inside. Somewhere in my hometown right now, a long, wet Norway rat is poking its twitchy pink nose above the water surface in a toilet bowl. Seattle also has another species, roof rats, which nest in trees and skitter along telephone lines. In the Middle Ages, they may have transmitted plague. ¶ From Seattle to Buenos Aires, urban rat populations are rising—as much as 15 to 20 percent in the past decade, according to one expert. Charismatic animals like elephants, polar bears, and lions are all in decline, yet inside our cities, we find it hard even with extraordinary efforts to keep rat populations in check. ¶ Of all the animals that thrive in our world—pigeons, mice, sparrows, spiders—we feel strongest about rats. Rats have a reputation for being filthy and sneaky. They're seen as signs of urban decay and carriers of pestilence.

NEW YORK CITY

Rats raid a trash can in lower Manhattan's Tribeca neighborhood. New Yorkers with uptown and downtown addresses dump enough trash on the streets for rats to be able to live out their lives less than 150 feet from where they were born. People with Midtown addresses—along with commuters and visitors to restaurants, theaters, and Times Square—provide ample edible trash for rat populations there as well.

ALL IN THE FAMILY

Take one year in a typical urban rat colony—how fast might it grow? Researchers estimate that a litter of nine pups 10 weeks into the year would grow to 270 pups by the 30th week and wrap up with a whopping 11,907 rats by year's end (population growth measured in word width, right). Rats usually reach sexual maturity by 12 weeks, and litters can vary from two to 14 pups. Reproductive rates are highly dependent on environment. The more shelter, food, and trash, the higher the rat count.



Week 30
270 rats

Week 41
1,818 rats

More than any other city creature, they inspire fear and disgust. People hate rats.

Do the little beasts really deserve it? Some of the things we hate most about rats—their dirtiness, their fecundity, their undeniable grit and knack for survival—are qualities that could describe us as well. Their filth is really our own: In most places rats are thriving on our trash and our carelessly tossed leftovers.

"It is us, the humans," New York rodentologist Bobby Corrigan says. "We don't keep our nest clean."

CORRIGAN IS A LEADING expert on urban rats. He has studied the animals since 1981 and works as a consultant for cities and companies around the world with rat problems. He's the one who told me about the alarmingly high rate of rat "toilet emergence" in Seattle.

I meet him on his turf on a warm April day at a park in lower Manhattan, one of the rat capitals of the world. Corrigan appears in a hard hat and neon orange vest, holding a clipboard. These accoutrements of authority will allow us to tromp through flower beds and subway tunnels without being challenged. Small statured and intent, Corrigan was raised in a big Irish Catholic family on Long Island. He talks like New Yorkers in the movies.

New Yorkers like to titillate one another with stories about sightings of rats as big as dogs. But the biggest rat Corrigan has ever heard of was a one-pound, 13-ounce creature that hailed from Iraq. He has a standing offer: $500 for anyone who can produce a two-pound rat. He doubts that he will ever have to pay up.

The dominant rat in New York City is the Norway rat, *Rattus norvegicus,* also known as the



brown rat. Brown rats are burrowing animals that are widest at the skull, so they can slip into any space wider than that (including the pipe leading to a toilet bowl). Corrigan points out a small hole directly behind the bench I am sitting on—it's the main entrance to a rat burrow. He explains that most rat burrows have three entrances, a main entrance and two bolt-holes for quick escapes.

Brown rats live in families. They have two to 14 pups at a time, keep their nests (which they often build in the garden beds of public parks) relatively clean, and patrol small territories. When the pups reach puberty, as early as 10 weeks of age, they move out and look for mates.

Corrigan and I head out on our rat safari. In a flower bed beside a courthouse he paces carefully, feeling the soil beneath his boots. Sensing a hollow space, he jumps up and down heavily a few times. Moments later a rat pops out of a nearby hole and makes a run for it—a dusty brown streak of small-mammal panic. I feel a little bad. Most New Yorkers, however, want all the rats in their city dead.

Just a week before I hunted rats with Corrigan, Mayor Bill de Blasio had announced "an aggressive new extermination plan" against rats in the city's public housing, part of a $32 million effort to reduce rats by up to 70 percent in the most infested neighborhoods.

Many cities try to conrol rats with poison. But unfortunately for the rats and for Corrigan's surprisingly tender heart, fast-acting poisons don't work well; rats that feel ill after a bite or two stop eating the bait. So the extermination industry uses anticoagulants, or blood thinners, which don't affect rats for hours and don't kill them for several days. The rats die slowly from internal bleeding. Corrigan hates to inflict such a death,

GRAPHIC: ALBERTO LUCAS LÓPEZ, NGM STAFF; MEG ROOSEVELT. PHOTO: MARK THIESSEN AND REBECCA HALE, NGM STAFF. SOURCE: BOBBY CORRIGAN, RMC PEST MANAGEMENT CONSULTING





WASHINGTON, D.C.

Specially trained Patterdale terriers—an alternative to poisons that can endanger birds—kill rats in the Adams Morgan neighborhood of the nation's capital. "All they want to do is kill rats," Scott Mullaney, co-owner of Unique Pest Management, says of his enthusiastic dogs.

WASHINGTON, D.C.

After dogs cornered some rats under a discarded piece of carpeting in an alley, their human colleagues used hockey and lacrosse sticks to stop them from fleeing—and shovels to dig out rats trying to hide in burrows. Some escapees scampered over the feet of reporter Emma Marris as they fled from the dogs.

A bundle of dead rats is the result of an hour of work for terriers named Raptor, Hula, Derby, and Minx; the dogs killed 31 rats that night. Minx once killed 17 adult rats in 10 minutes, working alone. The dogs are in high demand and work several nights a week across Washington, D.C. Onlookers often cheer them on.



but he fears outbreaks of disease. So he continues to lend his expertise to clients.

We proceed to Tribeca Park, where according to Corrigan the rats have learned to hunt and kill pigeons. "They leap on their backs like a leopard in the Serengeti," he says. But tonight the park is quiet. City workers might have recently injected burrows with dry ice, or frozen carbon dioxide, Corrigan says—a more humane approach to killing rats. As carbon dioxide gas wafts off the ice and seeps through the burrows, rats fall asleep, then never wake up.

Few who kill rats for a living hope for more than local or temporary success. After rats are poisoned in an area, Corrigan says, the survivors simply breed until the burrows are full again, and the new generations still find huge mounds of trash bags set out on the sidewalks of New York every night. Until cities radically change how they deal with their trash, Corrigan says, "the rats are winning this war."

In New York, when you see smoke-colored streaks on the sidewalk, chances are you're crossing a rat thoroughfare. The oil in their belly fur stains the concrete.

BROWN RATS LIKELY ORIGINATED on the Asian steppes, where they first learned they could eat well by hanging out with humans. They spread with trade along the Silk Road, and were established in parts of Europe by about 1500. (The misnomer "Norway rat" may have arisen when an infested ship that happened to be Norwegian docked in an English port.) They colonized today's United States before it had that name, by the 1750s, and apparently from both the east and the west. Brown rats along the East Coast are descended mostly from European ancestors, but West Coast rats are a mix of European and Asian genetics.

Roof rats—*Rattus rattus,* also known as black rats—are a global species as well. They may have originated on the Indian subcontinent and adapted to human settlements millennia ago, when humans invented agriculture. They reached Europe by A.D. 300, in time for the decline of the Roman Empire.

Black and brown rats alike traveled with explorers and traders, then settled down to eat our trash and steal our food. Today in Africa the median farm still loses 15 percent of its yield to rats. In Asia rats and other rodents eat enough rice each year to feed 200 million people.

Pacific rats, a third species of *Rattus,* are a different story: Polynesian explorers sailing from Tahiti and other islands intentionally brought them along in their canoes—as food. They cooked them in their own fat to make rat confit; they made beautiful cloaks of the fur.

As the Polynesians colonized various Pacific islands, tiny rodent explorers settled with them. In fact the rats' genetic family tree has been used to shed light on when and in what order various islands were discovered. Between 1200 and 1300, Polynesians and their companions reached New Zealand—which until then had no mammals at all other than bats.

On some small, remote islands, rats have done as much damage as human invaders. On Easter Island they're suspected of having wiped out palm trees by eating all the nuts. On other islands they threaten seabirds by eating eggs and chicks.

The ecological consequences can be far-reaching and surprising. One study found that by massively reducing bird numbers on some islands in the Indian Ocean's Chagos Archipelago, rats also interrupted the flow of bird poop into the ocean, where it fertilizes ocean plants. As a result, plant-eating damselfish



RAJASTHAN, INDIA

Not everyone hates rats. Perhaps the world's only temple for rats is Karni Mata. Here black rats whose wild ancestors may have originated on the Indian subcontinent and learned to thrive in cities are thought to be reincarnated storytellers and are fed milk and food.


2018





RAJASTHAN, INDIA

Two rats at Karni Mata Temple box to determine which is dominant. Rats are social animals that take good care of their off-spring. Studies show they will free a fellow rat from a small cage—even if it means giving up a treat. This suggests to some researchers that rats feel empathy.



CO DUNG, VIETNAM

Smoked rats are sold by street vendors as food. Rats are pests in Vietnamese rice fields. But with more than 7.5 billion humans and who-knows-how-many rats on Earth, there is room for them to be simultaneously disgusting and delicious, holy and horrifying.

IAN TEH


YAMAHA

were smaller and grew more slowly around the islands with rats than the islands without.

Fighting back, conservationists have been trying to eradicate rats with ambitious poisoning campaigns, targeting larger and larger islands. At 1,500 square miles, South Georgia, near Antarctica, is the current record holder: In May 2018 it was declared rat free after helicopters dumped 330 tons of poison in five years on its stark landscape, at a cost of $13 million. With the rats gone, conservationists expect to see an explosion in the number of albatrosses, skuas, terns, petrels, and South Georgia pipits and pintail ducks.

THE ISLAND NATION of New Zealand is thinking even bigger. It plans to kill all the rats in the country—with traps and poison baits spread over some 100,000 square miles—to try to save its rare native birds, including the iconic flightless kiwi.

In Wellington, the capital city, I visit one of the first rat-free oases, a 556-acre sanctuary called Zealandia. Surrounded by a seven-foot metal fence with a mesh too tight even for a rat to wriggle through, the sanctuary is home to such odd birds as the hefty, flightless takahe and the manic *hihi*. In the global urban landscape, Zealandia is a triumphant anomaly—"a reversal of the idea of the city as a biodiversity wasteland," says Danielle Shanahan, the sanctuary's conservation manager.

As the populations of native birds have increased inside the sanctuary, they have spilled over the fence. In response, bird-loving New Zealanders have formed citizens' groups to trap rats and other predators in parks around Zealandia. The aim is to create a "halo" of habitat that the birds can expand into. Wellington families now spend weekend afternoons acting as rodent death squads, setting and clearing rat traps. For the first time in generations, birds such as the North Island saddleback, or *tīeke,* can be heard singing their sweet songs in the city center.

Some New Zealanders, however, have doubts about the Predator Free 2050 campaign, which also plans to eradicate stoats and Australian possums. Biologist Wayne Linklater of Victoria University of Wellington calls the plan "unachievable" and says the poisons being used are too cruel. The whole thing is a distraction, he says: Many native species are more threatened by overgrazing and habitat loss than by predation.

Criticism comes also from members of the Ngātiwai, a tribe of Maori on the North Island. Their Polynesian ancestors brought the kiore, as they call the Pacific rat, to New Zealand, and they consider themselves guardians of the rats—which they still eat occasionally. Ngātiwai Trust Board CEO Kris MacDonald describes the kiore as "half the size of a New York sewer rat, all nice and fluffy and tasty looking."

Off the northeast coast of the North Island, the tribe manages Zealandia's mirror image: a steep but beautiful rocky islet called Mauitaha, which may be the world's only rat sanctuary. It's not exactly teeming—on an overnight visit there, hoping to eat a rat, I failed even to spot one—but someday it may be the only place in the country where kiores persist at all.

Hori Parata, a Ngātiwai environmental resource manager and my guide on Mauitaha, tells me a story about bringing a kiore in a cage to a social gathering. An old man approached and started talking to the rat, tears wetting his face. He had thought they were all gone.

RATS MAY BE EMPATHIC. SOME HAVE PASSED UP
GORGING ON CHOCOLATE
SO THEY COULD FREE OTHER RATS FROM CAGES.

ONE SUMMER NIGHT in Washington, D.C., photographer Charlie Hamilton James and I go rat hunting with a company called Unique Pest Management, which uses trained Patterdale terriers to dispatch rats that are bothering people.

In the Adams Morgan neighborhood, rich in restaurants, we watch the dogs work as a team to kill 31 rats in a single alley—a small fraction of the population, no doubt, but the company claims that with a few visits it can scare survivors into moving away. As the terriers go about their business, the human employees use hockey sticks to stop rats from fleeing the killing zone. Neighbors cheer from their windows.

Despite their bad rap, rats have redeeming qualities. They're smart—and maybe empathic too. In one study, rats freed other rats from cages, even though it gained them nothing and even when they could have gorged on chocolate instead. The researcher behind the study, neurobiologist Peggy Mason of the University of Chicago, says that typically, once the helper rat frees his companion, "he follows the liberated rat. He jumps on him and he licks him"—apparently to console the distressed animal.

Still, most of us really hate rats. Is it the nocturnal furtiveness, the way rats act like they have something to hide—unlike squirrels, say, which look you in the eye as they raid your bird feeder?

"It is the tail," says Laurinda Williams, who breeds rats on Long Island and sells them as pets. "If it weren't for the tail, everyone would have rats."

Val Curtis, a behavioral scientist at the London School of Hygiene & Tropical Medicine and an authority on disgust, says rats are considered disgusting in nearly every human culture—and it's probably not just the tail. "We are preprogrammed to learn to avoid things that make us sick," she says. As humans evolved, the ones who didn't mind sharing space with rats were more likely to die of rat-borne illnesses—and less likely to have descendants—than the ones who were revolted. Thus most of us today have inherited an innate revulsion, Curtis says, "in the same way we are programmed to find saber-tooth tigers scary."

In the Long Island rattery, which is a room in her parents' house, Williams shows me animals with fancy coat colors and patterns. She talks about the complexities of keeping the rats healthy and selecting for easy, calm temperaments. It's a lot of work. The rat room has a strong, musky smell, both sweet and foul. Her scented candle doesn't quite overpower it.

Williams walks over to a large cage and picks out a fat gray rat with an ivory belly and a split ear from a youthful brawl. His name is Dexter. "This is my heart rat," she says. "Your favorite rat is your heart rat. You get very bonded."

I hold Dexter briefly, and he wanders around on my hands. I'm surprised to feel how much he's trembling.

CORRIGAN, THE RAT EXPERT, doesn't have a heart rat now, but he has owned pet rats in the past. Decades of trying to outsmart them has made him not only respect but really like them.

"I admire this animal. I love this animal. That's my life's paradox," he says.

He welcomes New York's use of dry ice instead of blood thinners—though the city isn't doing it just to reduce rat suffering. Hawks, owls, and other raptors are increasingly living in the city, and New Yorkers don't want to see them dying from eating poisoned rats. The rats are considered vermin; the raptors are welcomed as heartening signs of nature returning to the city.

Scientists these days are working on what might be the ultimate in rat control: a genetic engineering technique that would spread infertility genes through a wild rat population. If fears of unintended consequences can be overcome, this method might one day enable us to wipe out rats on an unheard-of scale, without poison.

Might we miss them? Without rats, New York and other cities would have fewer hawks and owls. Tons of carelessly discarded food would simply putrefy in place, rather than be carried off by a rodent cleanup crew. On YouTube there's a wildly popular video that shows a New York rat dragging an entire slice of pizza down the stairs of a subway station. A comment praises the animal as "a true New Yorker."

Rats help keep us from wallowing in our own filth: If we can't love them for it, respect and a little acceptance would be a healthy step. Outside a soup kitchen near Chinatown, after sunset, I meet a maintenance worker named Jonathan Hincapie who is having a smoke as he watches rats frolic on a heap of trash bags.

I ask if the rats bother him. "I don't mind rats," he says. "This is New York City." ▫

Emma Marris wrote *Rambunctious Garden,* a book about our relation to nature. She and wildlife photographer **Charlie Hamilton James** collaborated on the magazine's June 2016 feature on Peru's Manú National Park.



YOUR SHOT

HAITONG YU

PHOTOS FROM OUR COMMUNITY

WHO

Yu, a camera engineer living in Shenzhen, China

WHERE

The Choi Hung public housing complex in Hong Kong's Kowloon district. Its full Chinese name translates to Rainbow Village.

WHAT

Using a Nikon D610 camera with a 20mm F1.8 lens

While on vacation in Hong Kong, Yu visited the Choi Hung housing complex. The cluster of multicolored buildings is a popular photographic destination, appearing frequently on Instagram. Yu arrived at noon, hoping the midday sun would minimize shadows on the facades. Near one building, he noticed laundry hung out to dry (next to a sign that said NO LAUNDRY!). The drying clothes added a new dimension—and later, when he looked at this shot, he liked picturing the shirts and pants as emoji.

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